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Editors • Ashraf Samarah and Ashish Bagwari

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Preface: Proceeding on International Conference on Wireless Technologies, Networks and Science-2022 ICWTNS-2022

On behalf of the **International Conference on Wireless Technologies, Networks and Science-2022 "(ICWTNS-2022)"** Executive Committee, we are pleased to welcome you to the International Conference on Wireless Technologies, Networks and Science-2022 "(ICWTNS-2022)". The ICWTNS-2022 provided a prominent international forum for researchers and practitioners to exchange information regarding novel aspects of technology, application, and service development within the multidisciplinary framework of Communication Engineering, Wireless Sensor Networks, Wireless Mesh Networks and Multimedia Networks, Science such as mathematics, computer, environment, and many more.

The Keynote Speakers, Distinguished Lecturers, Invited Talks, and paper presenters at the ICWTNS-2022 conference concentrated on the current running technologies in the areas of wireless, networks, and science, and their issues & challenges.

This year, the response to the conference's call for papers has been outstanding. Many individuals and organizations contributed to the success of this conference. Together with the Technical Program Committee, they worked diligently to select papers and speakers that met the criteria of high quality and relevance to our various fields of interest. We are grateful for all their hard work and efforts. It takes time and effort to review a paper carefully, and every member of the Technical Program Committee is to be commended for his or her contribution to the success of this conference.

The TPC Chairs, Co-Chairs, and members had the unenviable task of coordinating the peer review process and putting together an outstanding technical program. They deserve a lot of thanks. The success of this conference would not have been possible without the dedication and efforts of the members of the Advisory Committee, Publicity Committee, Steering Committees, and other committees.

It was an honor and a pleasure for us to accept the responsibilities and challenges of serving as Conference General Chairs. We sincerely hope that everyone who attended the conference enjoyed themselves and learned something new. For details on upcoming conferences, journals, webinars, and grant-writing services, kindly visit our website (www.icwtns.aairlab.com or www.aairlab.com).

Thanks

With Regards

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Impact of Land Surface Temperature on Ecosystem disturbance in Lower Shivalik range of Himalayas foothills [Uttarakhand, India] using Landsat 8 Imagery

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Abstract: In monitoring the ecosystem and climatic changes of the geomorphological area estimation of the Land Surface Temperature (LST) is important. In this paper we have estimated the fluctuation in ecosystem by correlating with LST, Atmospheric Temperature, Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), radiation and precipitation using Landsat 8 (OLI/ TIRS) imagery of Dehradun, Uttarakhand, India. Remotely sensed image of three consecutive year's i.e 2014, 2015 and 2016 of November were acquired to observe the correlation and inverse correlation among the parameters. In this paper Dark Object Subtraction and Radiometric Correction are done before image pre-processing Because of the cloud free conditions. Here no Atmospheric Correction is done. Ground trothing is also done to correlate the parameters obtained through satellite imagery. Regression analysis using R^2 coefficient is also determined on the above parameters to estimate the correlation among them. R^2 coefficient between LST and air temperature, max NDVI and max air temperature, max NDWI and LST, max NDWI and min NDVI shows positive correlation with accuracy equals to 99%. R^2 coefficient between Radiation and LST shows inverse correlation which shows the direct impact on ecosystem disturbance.

Keywords: LST, NDVI, NDWI, Ecosystem Disturbance, Landsat8, Dehradun

INTRODUCTION

Process of water and energy exchange with the atmosphere continuously. It is playing an important role in the scientific studies areas like global climate change, hydrology and ecology. Surface temperature foremost used in the study of urban climatology. Urbanization leads to the atmospheric temperature difference in urbanized and non-urbanized areas, pertaining the temperature of non-urbanized area as colder than urbanized area during night. The phenomenon is commonly called as urban heat island (UHI) [1]. The two types of heat islands are differentiated by the canopy layer heat island (UCL) and the boundary layer heat island (UBL) [2]. UCL consists of air gap between the tree canopies and grounds serving as the roughness elements, with the upper boundary below the roof surface while the UBL, with a lower boundary influencing the urban surface [3]. Due to deforestation and human activities, certain land surface properties such emissivity, as low and high albedo, moisture,heat carrying capacity results in the decrease of evapotranspiration [4].For this purpose thermal band of the remotely sensed satellite is used. By this we can find the land surface temperature and impervious surface. Remotely sensed images which are ranging from coarse resolution (Advanced Very High Resolution Radiometer [AVHRR]) to the term used as medium resolution (Landsat Thematic Mapper [LTM] and Enhanced Thematic Mapper Plus [ETM+]) .These techniques are widely being used by the researchers for analysing climatic changes urbanization effects [5-7]. Split Window method (SW), Dual Angle algorithm (DA), single channel algorithm (SC) and Mono-Window algorithms are the commonly used algorithms to find the LST [6, 8-10]. In experimentation the 60-m spatial resolution Thermal Infrared Sensor (TIRs) usually derive the surface temperatures. Deng and Wu estimated land surface temperature using spectral unmixing and thermal mixing approach of Cedarburg and Garfton, Wisconsin, USA using IKONOS satellite imagery [11]. Weng et al, uses Normalised Difference Vegetation Index (NDVI) to estimate LST - vegetation relationship through spectral mixture analysis with a constrained of least-square solution of Indiana, IN, USA using Landsat ETM+ imagery [3].

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AmalyahyaAlshaikh estimates the correlation between Vegetation Cover (VC) and LST using NDVI of Wadi Bisha, south the Kingdome of Saudi Arabia (KSA) using Landsat 7 imagery [12].

Land surface emissivity (LSE) plays a crucial role in determining the LST. Emissivity is defined as the ratio of the actual emitted radiance from the surface of measurements to the black body radiation (Planck's Law) at the same thermodynamic temperature [13]. Average emissivity of an element of earth's surface is calculated from measured radiance and the LST which is defined as LSE. Thermal emissivity is defined as efficiency of the surface due to which it can emit stored heat in the form of thermal radiance. It is necessary because it controls the atmospheric and energy-balance model and must be known with the brightness temperature to link the heat content with the surface emitted. The emissivity of a surface depends on many factors including water content, roughness, chemical composition and structure. For vegetation, the factors affecting the emissivity include plant species, growth state and areal density. The kernel model of Bidirectional reflectance distribution function (BRDF) is used to estimate the emissivity of the surface [14]. By knowing the emissivity spectrum, the differences in wavelength dependent spectral features can map surface materials. It is also helpful in terrestrial and planetary geological studies [15].

STUDY AREA

The study area is located in the lower shivalik range of Himalayas, covering the western part of the Doon Valley, Dehradun, Uttarakhand, India. The district is situated in the North Western corner of Uttarakhand state. The area covers (a total of) an approximately 1201.12sq km and its longitude and latitude data lies between 77°34'0"E and 78°19'0"E and 30°32'0" N and 29°57'0" N.(topographical map no. 53F/15 on scale-1:50,000by Survey of India (SOI)). The average altitude of the area is 640 m above the main sea level. The district is drained by Ganga, Yamuna and its tributaries. From east, the river Ganga is joined by Yamuna river in the west. The two main tributaries of the river Ganga include Song and Suswa. The main tributary of river Yamuna is Tons. The western part of the Doon Valley is drained by Asan barrage; a Yamuna river tributary. Yamuna river roughly divides the dehradun district into two halves i.e the hilly region in the north while the doon valley in the south. The area is characterized by the seasons of warm summers with showery monsoon. It has mild spring and cold winter. The summers are not too hot while the temperature reaches below freezing point in the winter. The temperature drops below the freezing point not only at high altitudes but also in some places of dehradun during winter season, when the higher peaks are covered with snow. In the summer season the temperature varries from 16.5°C to 38°C while in winters it varies from 3°C to 15°C. The Dehradun district has an annual rainfall of 2073.3mm (in 2013).Most of the rainfall is received in the month of June to September. The area has good vegetation growth due to good climate, high elevation and the soil. Shrubs which are compromised in the study area includes chamror, derodendruminfortuntum and lantana camara. Terminalia alata is included as an herbal species [16].

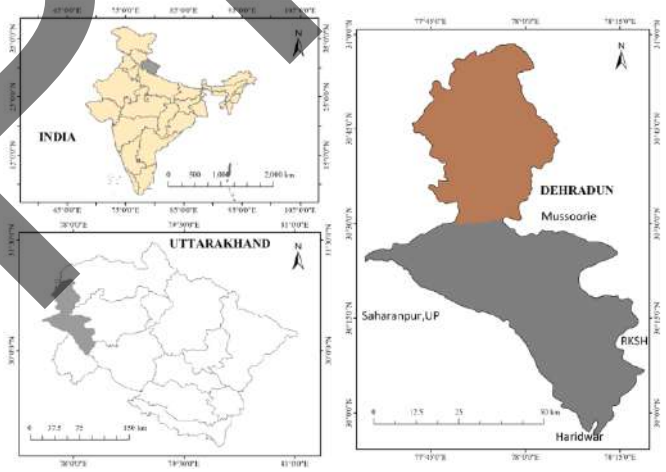


FIGURE1. Map showing the location of Dehradun City and the test area

METHODOLOGY

The methodology included for estimating the effect of Land Surface Temperature is shown in fig 2 and preparation of spatial database for the metropolitan cities. GIS was utilized for creation of thematic layer such as land use/ land cover map.

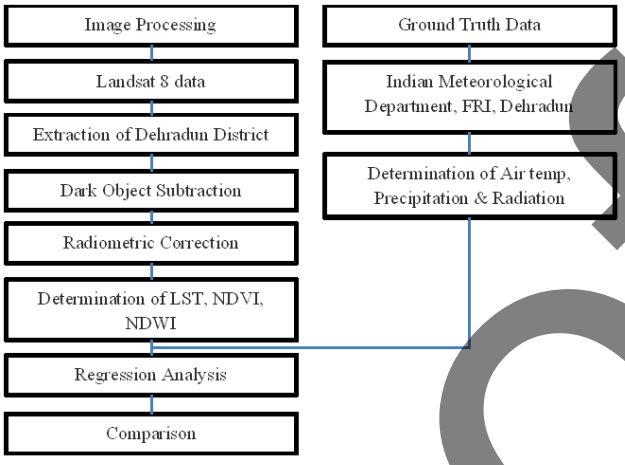


FIGURE2. Block Diagram representation of the proposed algorithm for estimating Land Surface Temperature using Landsat 8 data

For estimating the Land Surface Temperature Landsat-8 OLI/TIRS image is used. The data acquired for Dehradun in the month of November 2016; using WGS84(a geographic coordinate system). Nowadays, USGS (U.S. Geological Survey) allows the user to choose between a pre-processed data and a raw data. The study includes the pre-23 processed data hence the image corrections are not done. Single Window method is used to estimate the Land Surface Temperature. which is given by the equation -

$$LST = \frac{BT}{1+w*\left(\frac{BT}{p}\right)*\ln(\epsilon)} \quad (1)$$

Here BT is *Conversion of radiance to At-sensor temperature* which is used for the conversion of radiance to satellite temperature using the equation:

$$BT = \frac{K2}{\ln\left[\left(\frac{K1}{L\lambda}\right)+1\right]} - 272.15 \quad (2)$$

L_λ *is known as Top of Atmospheric Spectral Radiance* used to convert the digital number to spectral radiance using radiance rescaling factor as is provided in the metadata file.

From $p = \left(h * \frac{c}{s}\right) = 14380$;K1 is a band specific thermal constants obtained from metadata file.

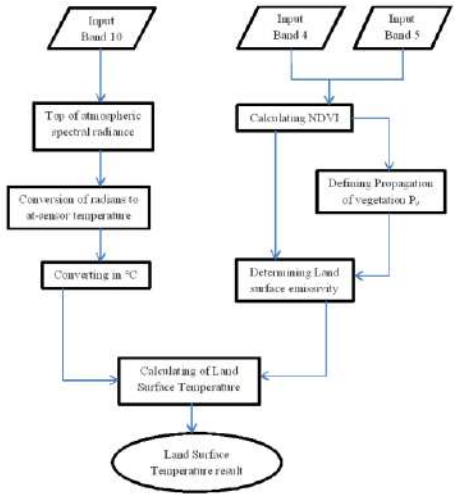


FIGURE3. Flowchart of approach used in determining the Land Surface Temperature

Emissivity Calculation (*NDVI method)*: ε is calculated for the accurate calculation of land surface temperature (T) . The equation used for calculating the emissivity

$$\epsilon = 0.004\, Pv + .986 \tag{3}$$

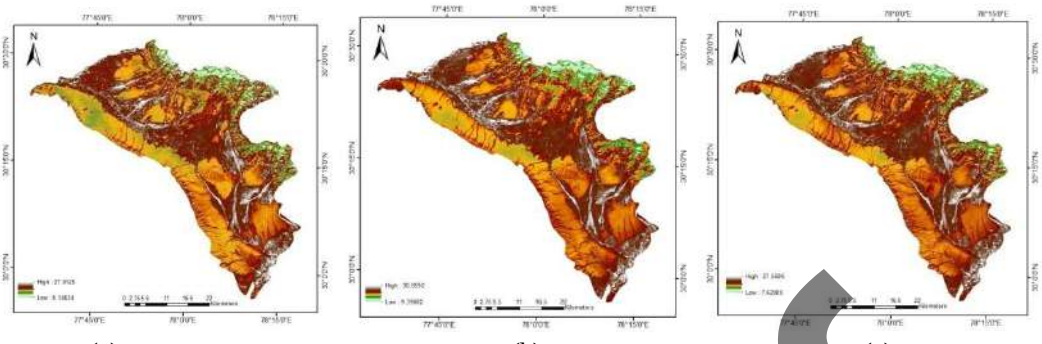
$$\text{where } Pv = \left(\frac{NDVI - NDVI\ min}{NDVI\ \max - NDVI\ min}\right)^2 \tag{4}$$

RESULTS & DISCUSSION

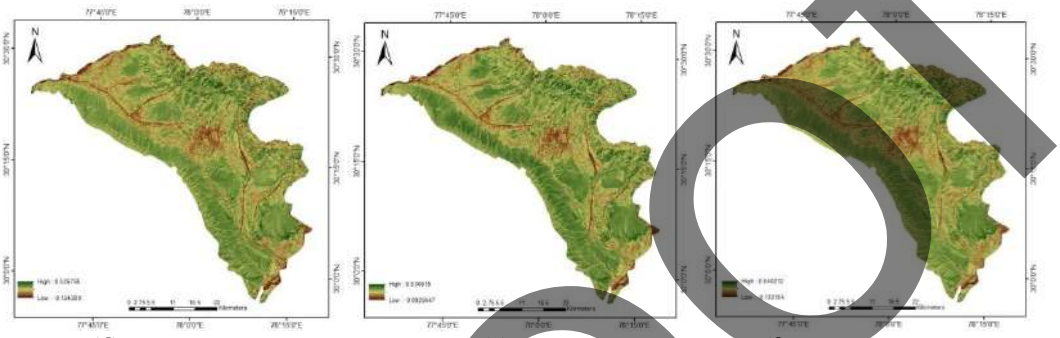
Based on the discussions above, we estimated LST, NDWI, and NDVI in Erdas Imagine and ArcGIS software's. Table 1 will show the result of Land Surface Temperature, NDWI and NDVI.

Table 1: Results obtained for Land Surface Temperature, NDWI, NDVI, Sun radiation and rainfall

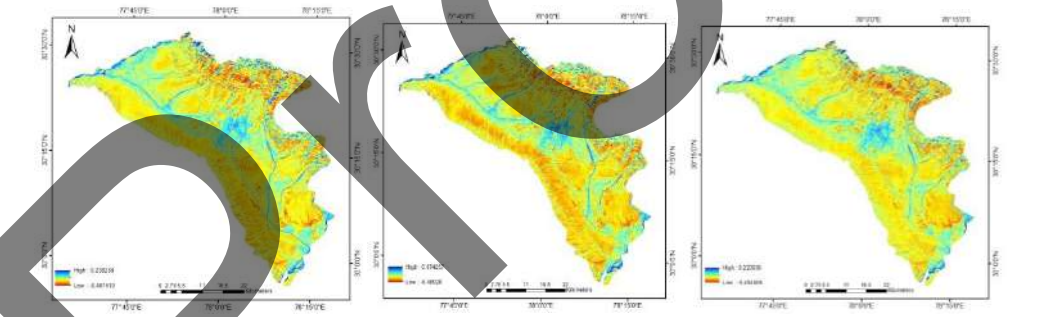
Years	$Temp_{avg}$ (in °C)	LST_{min}(in °C)	LST_{max}(in °C)	$NDWI_{min}$	$NDWI_{max}$	$NDVI_{min}$	$NDVI_{max}$	Radiation (MJ/m^2/day)	Rainfall (mm/ month)
2014	16.91	6.146	27.0125	-.4875	.238258	-.154289	.526766	13.69	0.00
2015	18.15	9.397	30.8592	-.48928	.174057	-.092845	.536619	13.40	3.10
2016	17.5	7.6298	27.5606	-.49461	.223605	-.133154	.540212	14.40	0.00



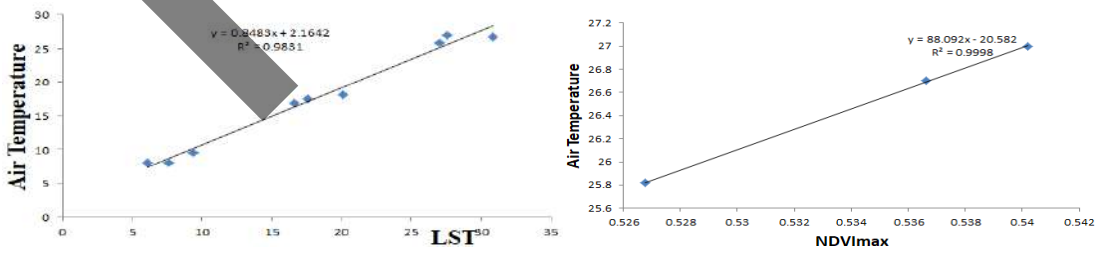
(a) (b) (c)



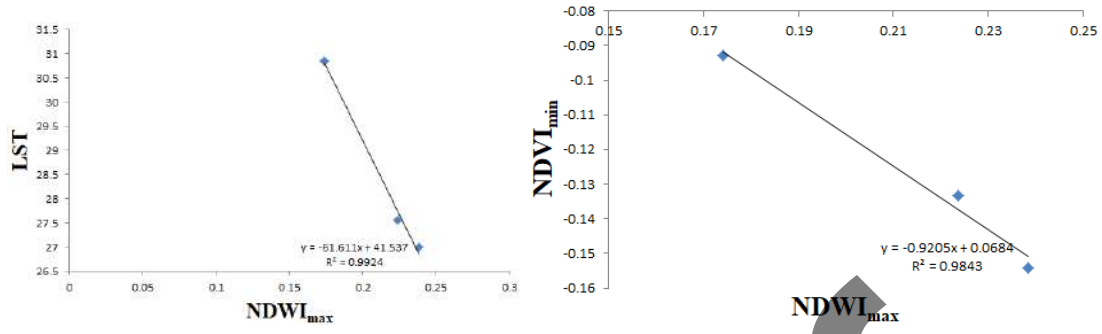
(d) (e) (f)



(g) (h) (i)



(j) (k)



(l) (m)

FIGURE4. [a-c] Showing Land Surface Temperature, [d-f] Normalized Difference Vegetation Index (NDVI), [g-i] Normalized Difference Water Index (NDWI), (j) Relation between LST and Air Temperature, (k) Relation between $NDVI_{max}$ and Air Temperature, (l) Relation between $NDWI_{max}$ and LST, (m) Relation between $NDVI_{min}$ and $NDWI_{max}$

CONCLUSION

The regression coefficient between Land Surface Temperature and Air temperature gives .9831 which shows that the air temperature increases with increase in Land Surface temperature. The main reason for the increase is the effect of heat flux on the surface. After analysing the R^2 coefficient between air temperature and $NDVI_{max}$ the result shows that the vegetation index (in special species) is fluctuated when Land Surface Temperature and air temperature maximize. The main reason for the increase is the impact of Sun's radiation. Analyzing the relation between $NDWI_{max}$ and LST, a regression coefficient of .9924 is obtained. The result shows that water index decreases with increment of Land Surface Temperature due to more evaporation on the surface near to water bodies. Hence, the Land Surface Temperature maximizes near to the water bodies because of sun's radiation directly falling on the surface and thus increasing the water vapour evaporation. Lastly, the regression analysis between NDVImin and NDWImax shows that vegetation index is more when water index is maximum. This is due to more availability of water content on the Land Surface.R^2 coefficient between LST and air temperature, max NDVI and max air temperature, max NDWI and LST, max NDWI and min NDVI shows positive correlation with accuracy equals to 99%. In future, we will extend the work for different climatic conditions with more sample point collection.

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SMART ANTENNAS IN DIRECTION FINDING

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Abstract.A smart antenna (or cognitive aantenna or adaptive array) is a self-optimizing intelligent and interactive antenna which can help in the detection of the signal in case of background noise or interference. The work includes in designing the Smart Antenna as a transmitter of Uniform Rectangular Array (URA) of Reflector Backed Dipole Antenna (RBDA) placed at Netaji Subhash University of Technology (NSUT), East campus, New Delhi. The array is placed at a height of 169 meters above ground level. Each of the RBDA is operating at 10 GHz frequency. Five receiver locations are selected such that the antenna changes its beam pattern in order to find the maximum receiver placed in the nearby locations using amplitude scanning and steering vector techniques. The results concluded that when Taylor window is used for tapering the beam, the convergence of the algorithm is optimum.

Keywords: Taylor Window, Kaiser Window, Uniform Rectangular Array, Reflector Backed Dipole Antenna

INTRODUCTION

With the technological advancement, the use of smart antennas in future wireless system can help in efficient spectrum usage, minimizing new wireless networks, guranteed Quality of Service (QoS) and so on [1]. The major advantage of Smart Antenna Array includes in providing the narrowbeam towards the user of interest while nulling the other users which are part of the network [2]. This allow high signal-to-noise ratio with lower power in each cell (*or Space Time Division Multiplexing*). The another advantage of using the smart antennas include in the mitigation of the deleterious effect of multipath [3]. For the same, the *constant modulus algorithm* can be used in mitigating the multipath effect. This will help in reducing the receiver fading and high data rates can be achieved easily by reducing both the co-channel interference and multipath fading. These antenna can also be used in *finding the direction* (DF) more accurately by finding *angle of arrival (AOA)*[4]. The technique can be used in the radar system for accurately tracking the object.Some other advantages of using the Smart Antennas are Clutter Suppression, Blind Adaption, Multipath Mitigation, Space Divison Multiple Access (SDMA), improved system capabilities, higher signal to noise ratios, increased frequency reuse, sidelobe cancellation or null steering, MIMO capability in communication and radar systems [5].

Beam scanning is a technqiue to associate the main beam of the antenna array in the desired direction with the associated feed network [6].There are two conventional techniques available for the beam scanning in phase array. The beam scanning can be achieved by either making variations in the phases of elements excitation or by frequency scanning. But both the techniques carry some disadvantages. The authors in [7] achieved the beam scanning by variation in magnitude of elements excitation. The beam scanning in phased arrays requires the linear phase distribution variation across antenna elements.This is accomplishedeither by using the variable phase shifters. The authors in [8] considered reflector backed antenna with loop-shaped parasitic elements to investigate the characteristics of S_{11}. It is found that the loop peripheral length and low-frequency resonance affects the dipole elements and length. Additionally, the high-frequency resonance gets affected by the peripheral length or the width perpendicular to the dipole. Neto et al, [9] illustrate that for scan of wide angles (45°), the connected arrays of dipole are the most suitable, that helps to retain the optimised number of receive or transmit modules. The wide band matching can be obtained by the tuning of the reactive energy presented in the feeds of the connected dipoles. It gave 40% BW even at the scanning angle of 45° in case of lowest cross polarization level with a planer connected arrays of dipoles.With the growing research in the field of Machine Learning, the use of Artificial Neural Network (ANN)

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in the designing of smart antennas is emerging as the ANN can create the complex non-linear boundaries for classification purpose. Also, Neural Networks plays a predominant role in modellingthe input output relation where the relation is quiet complex. Thus, Radial basis function (RBF), Multi-layer perceptron (MLP) and Hopefield Neural Network (HNN) are the most suitable Neural Network based technique for designing of smart antenna arrays [2].

This research will provide the amplitude based beam scanning technqiue to find the maximum coverage of the receiving antenna. To taper (apply weights) the beam, several windows are applied in order to get the maximum coverage of the receiver site. These include Taylor window, Tukey window, Blackman window, Chebyshev window and Kaiser window. The organization of the paper is as follows, section II will provide a basic comparsion between the smart and the traditional antenna. Section III will provide Reflector Backed Dipole Antenna with the E and H plane radiation pattern. Section IV will provide the windowing technqiues used to find the amplitude of the beam. Section V will provide the Direction Finding and Vector Steering techniques. Section VI will provide the results obtained while section VII will provide the conclusion and future scope of the work.

COMPARSION BETWEEN SMART ANTENNA ARRAY AND TRADITIONAL ARRAY

The traditional antenna arrays are fixed beam dumbed antenna array which doesnot change their radiation pattern according to the environment. These array doesnot posses any self healing power and the complete system needs to be changed once damaged or destroyed [10]. Since, the process of adaptive beam forming is not there in traditional antenna, hence the signal to noise ratio remain unaltered. Therefore, the radiation pattern obtained is unchanged as no algorithm is used for matching the output with the desired signal response. The smart antennas are the intelligent antenna patterns which adapt to change their beam pattern in accordance with the environment. They possess the self healing power when damaged and also posses low performance loss in case of any destroy [11]. These antennas adapt or adjust their beampatterns in such a way that maximum of the signal power is obtained while minimizing the noise content in the signal.There have been numerousof algorithms that have been developed for adaptive beamforming.These algorithms adjust the weight in such a way that the output matches with the desired signal response and the radiation pattern obtained is optimum radiation pattern.

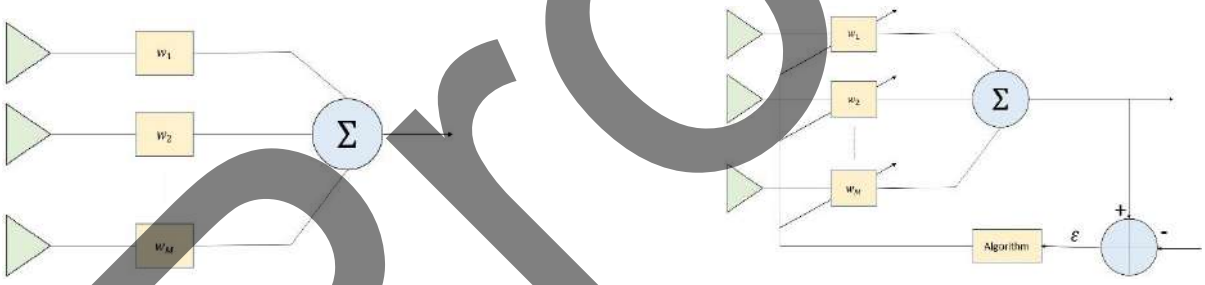


FIGURE 1 a). Showing the Traditional Antenna Array **b).** Showing the Adaptive Beam forming pattern

REFLECTOR BACKED DIPOLE ANTENNA (RBDA)

A reflector antenna is a device used to reflect the electromagnetic waves in a specified direction. The antenna can take many form (geometries) but the most common includes in Plane, Corner and the Curved Reflector. For our analysis purpose, we use a simple Reflector Backed Dipole antenna with E-plane ($x-z$ plane) radiation patterns in the far-field region [12] as

$$E_\theta = \sin(kH\cos\theta)\frac{\cos(kl_e\sin\theta) - \cos(kl_e)}{\cos\theta}$$

$$E_\varphi = 0$$

While the H-plane ($y-z$ plane) radiation patterns in the far-field region

$$E_\theta = 0$$

$$E_\varphi = \sin(kH\cos\theta)\cos(kw_e\sin\theta)$$

The directivity of RBDA is given by

$$G = \frac{4\pi}{\theta_{3E}\theta_{3H}}$$

And the achievable Electric field strength is given by

$$E = \frac{\sqrt{30P_T G}}{d} = \frac{\sqrt{120\pi P_T}}{d\sqrt{\theta_{3E}\theta_{3H}}}$$

where θ_{3E} and θ_{3H} are the 3 dB beamwidths of the test antenna in E plane and H plane respectively, while l_e and w_e represents the equivalent length and width respectively and P_T represents the radiated power of the test antenna.

WINDOWING TECHNIQUES FOR TAPERING

Windows represent the finite duration sequences which are used to modify the impulse response of the FIR filter in order to provide smooth transition from pass band to stop band while reducing the ripples. In our work, different windows are used to adjust the weights of the beam scanner in order to receive the maximum coverage. The windows used in the study includes:

1. ***Dolph-Chebyshev Window***: For a given Peak Side lobe level, this window achieves the narrowest mainlobe. The taper (weight) function of this window is defined by its frequency response and given as

$$W(f) = \frac{\Psi(f,N)\cos(\pi\sqrt{f^2 - A^2})}{\cos(\pi\sqrt{-A^2})}$$

where $A = \frac{\operatorname{acosh}(\eta)}{\pi} = \frac{\ln(\eta+\sqrt{\eta^2-1})}{\pi}$, $\Psi(f,N) = \begin{cases} +1, & for\ N\ odd\ or f \geq 0 \\ -1, & else \end{cases}$ and $\eta = 10^{-\frac{S}{20}}$ and S represents the side lobe level with respect to main lobe peak.

***2. Taylor Window*:**This window approximates the*Dolph-Chebyshev window's* constant sidelobe level for a parametrized number of near-in sidelobes [13] and after that it allows the weight beyond this. This makes the window practically realizable and makes it popular for signal processing algorithms. The window function is given as

$$w(t) = \left[1 + 2\sum_{m=1}^{(\bar{n}-1)} F_m \cos(2\pi m t)\right] \operatorname{rect}(t)$$

where the coefficients are calculated as

$$F_m = \frac{-\left[\frac{(-1)^m}{2}\right]\prod_{n=1}^{(\bar{n}-1)}\left[1-\frac{\frac{m^2}{\sigma^2}}{A^2+\left[n-\frac{1}{2}\right]^2}\right]}{\prod_{\substack{n=1 \\ n\neq m}}^{(\bar{n}-1)}\left[1-\frac{m^2}{n^2}\right]}, \text{ for } 1 \leq m \leq (\bar{n}-1)$$

with$\sigma^2 = \frac{(\bar{n})^2}{A^2+\left(\bar{n}-\frac{1}{2}\right)^2}$ and $A = \frac{\operatorname{acosh}(\eta)}{\pi} = \frac{\ln(\eta+\sqrt{\eta^2-1})}{\pi}$, $\eta = 10^{-\frac{S}{20}}$ where $\bar{n}$ represents the distance from the mainlobe for which the sidelobes are constant.The Fourier transform of the continuous time window taper function is calculated to be

$$W(f) = \operatorname{sinc}(f) + \sum_{m=1}^{(\bar{n}-1)} F_m(\operatorname{sinc}(f-m) + \operatorname{sinc}(f+m))$$

3. ***Tukey Window:*** This window is named after the American mathematician John Wilder Tukey. This window contains flat center while the edges contain cosine tapers [13]. It is also a parametric window, and the function is given as

$$w(x) = \begin{cases} \frac{1}{2}\left\{1+\cos\left(\frac{2\pi}{r}\left[x-\frac{r}{2}\right]\right)\right\}, & 0 \leq x < \frac{r}{2} \\ 1, & \frac{r}{2} \leq x < 1-\frac{r}{2} \\ \frac{1}{2}\left\{1+\cos\left(\frac{2\pi}{r}\left[x-1+\frac{r}{2}\right]\right)\right\}, & 1-\frac{r}{2} \leq x \leq 1 \end{cases}$$

The parameter r is defined by the ratio of cosine-tapered section to the entire window length and ranges from $0 \leq r \leq 1$.

4. ***Kaiser Window:*** The approximation of ideal Maximum Energy taper is given by this equation. In the ideal Maximum Energy taper, the calculation of prolate spheroidal wave function is difficult and therefore, the scientist

approximates the calculation based on zero-order modified Bessel function [13]. The coefficient of kaiser window can be calculated using the following equation as

$$w(n) = \frac{I_0\left(\beta\sqrt{1-\left(\frac{n-\frac{N}{2}}{\frac{N}{2}}\right)^2}\right)}{I_0(\beta)}, 0 \le n \le N$$

Where, I_0 represents the zeroth-order modified Bessel function of first kind and

$$\beta = \begin{cases} 0.1102(\alpha - 8.7), & \alpha > 50 \\ 0.5842(\alpha-21)^{0.4} + 0.07886(\alpha-21), & 50 \ge \alpha \ge 21 \\ 0, & \alpha < 21 \end{cases}$$

5. ***Blackman Window***: The blackman window is an extension of the Generalized Raised Cosine window where the window adds another cosine term to the existing constant and single cosine term [13]. The addition of extra cosine term helps in the optimization of window taper function spectral characteristics. The general equation for blackman window is given as

$$w(n) = 0.42 - 0.5\cos\left(\frac{2\pi n}{L-1}\right) + 0.08\cos\left(\frac{4\pi n}{L-1}\right)$$

DIRECTION FINDING and VECTOR STEERING

The direction is found using the Angle-of-Arrival approach. The directional finding algorithms not only rely on received signal strength (RSSI) but also depends upon actual direction of the signal which makes the positioning easier. For finding the direction, we considered Amplitude Scanning Technique given by [7].The array uses only one fixed phase shifters and two amplitude control or signal splitters. Hence, the array factor is given by

$$\text{AF} = \sum_{n=1}^{N} e^{j(n-1)(kd\cos\theta+\beta)}.$$

Much of the research work is done on direction finding and beamforming using the scalar sensor array. These are capable of extracting only one component from the electric or magnetic field for processing. The angle of arrival estimation with proper accuracy requires complete vector field of polarization called vector sensor. The ideal vertical electric dipole can only detect Vertical Electric Field while the ideal horizontal dipole can only respond to Vertical Magnetic Field. The cross product of Electric and Magnetic field is given by poynting vector ($\bar{S} = \bar{E} \times \bar{H}$) which indicates the propogation of the direction of the incident wave and can be converted to Angle-of-Arrival estimation. Hence by replacing the scalar antennas with the vector sensor antennas, the angle of arrival can be estimated by both the approaches which include cross-product direction finding technique and traditional direction finding technique.

Steering Vector is the parametric representation of the vector sensor response to a uniform plane wave signal originating from any angle of arrival. CART is the traditional physical confriguation for the vector sensor processing and composed of 3-electric dipole antennas and 3-loop antennas or magnetic dipoles. The Electric dipole antennas are used to measure the Electric field components E_x, E_y, E_z while the Loop antenna are used to measure Magnetic field components H_x, H_y, H_z of the transverse electromagetic wave (TEM). The CART vector sensor is sensitive to two-dimensions that includes angle-of-arrival and polarization of the incident plane wave. The vector sensor steering can be expressed in terms of angle of arrival (θ, Φ) and polarization state (ϒ, η) of the incident plane wave of individual Electric and Magnetic field components for all the six axes $E_x, E_y, E_z, H_x, H_y, H_z$.

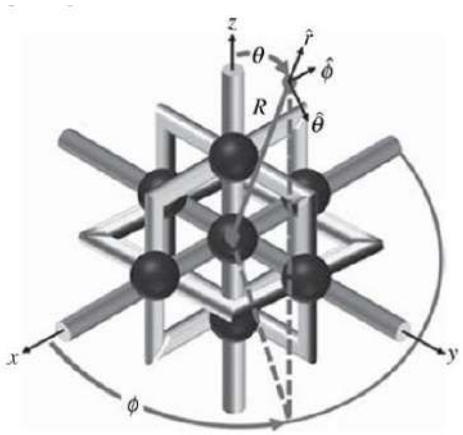


FIGURE 2. CART Vector sensor antenna and coordinate system definition

The general form of vector sensor steering vector is given by

$$\bar{a}(\theta,\Phi,\Upsilon,\eta)=\begin{bmatrix}E_x\\E_y\\E_z\\H_x\\H_y\\H_z\end{bmatrix}=\begin{bmatrix}\cos\theta\cos\Phi & -\sin\Phi\\ \cos\theta\sin\Phi & \cos\Phi\\ -\sin\theta & 0\\ -\sin\Phi & -\cos\theta\cos\Phi\\ \cos\Phi & -\cos\theta\sin\Phi\\ 0 & \sin\theta\end{bmatrix}\begin{bmatrix}\sin(\Upsilon)e^{j\eta}\\ \cos(\Upsilon)\end{bmatrix}=\bar{\Theta}(\theta,\Phi)\bar{p}(\Upsilon,\eta)$$

The few observations about the vector sensor steering includes first the steering vector size of 6× 1 means that single six-axis vector sensor contains six, scalar antenna that are co-located and are co-centered at a single location. The advantage of co-location and co-centre includes in the induction of no time delay between the elements. Second, the steering vector is also sensitive to the polarization of state and hence it is practically possible to separate the signals which arrive from the same direction. Third, it is also possible to separate the estimation of the angle of arrival from the polarization state which helps in simplifying the Direction-Finding Algorithms.

For our application, M signals arrive with the unique arrival angles and polarization states $\overline{\psi_m}=(\theta_m,\Phi_m,\gamma_m,\eta_m)$ such that the instantaneous response of the single vector will be given by where *w* and Φ are the carrier frequency and the phase of the incoming signals(t)

$$\overline{x_m}(t)=\bar{g}(\theta_m,\Phi_m)\bar{a}(\theta_m,\Phi_m,\gamma_m,\eta_m)E_{o,m}e^{j(w_m t+\Phi_m)}+\bar{n}(t)$$

$$s(t)=E_o e^{j(wt+\Phi)}$$

and $\bar{n}(t)$ is a 6× 1 additive complex valued noise vector. Hence the steering vector for thel^{th} vector sensor due tom^{th} signal is given by and thus the response due to l^{th} vector sensor

$$\overline{v_{vs,l}(\psi_m)}=q_l(\theta_m,\Phi_m)\bar{a}(\overline{\psi_m})=q_l(\theta_m,\Phi_m)\bar{\Theta}(\theta_m,\Phi_m)\bar{p}(\Upsilon_m,\eta_m)$$

in the array is generated by concatenating the L steering vectors which is finally given by

$$\overline{v_{vs}(\psi_m)}=\begin{bmatrix}\overline{v_{vs,1}(\psi_m)}\\ \vdots\\ \overline{v_{vs,L}(\psi_m)}\end{bmatrix}$$

with complete normalized response $\overline{x_m}(t)=\overline{v_{vs}(\psi_m)}s_m(t)+\bar{N}(t)$.

RESULTS

We consider a 7 × 7 Uniform Rectangular Array of RBDA as shown in figure 3b. Each of the reflector dipole antennas is operating at 10 GHz frequency and radiating in xy plane.The spacing between each element is $\frac{\lambda}{2}$ and the array is placed in yz-plane with the radiation in the x-direction. The radiation pattern for all the combined antennas is shown in figure 3c. We create a transmitter site at our college NSUT East campuswith the corresponding latitude (28.654470) and longitude (77.268027) using the antenna array formed above shown in figure3b. The frequency of the transmitter should be matched with the antenna's design frequency in order to get the maximum power.The transmitted output power is set to 1 W with the antenna height of 169 meters. Hence, figure 4a shows the image of the

transmitter situated at **campus**from the US Geographical survey map while figure 4b shows the correspondingradiation pattern.

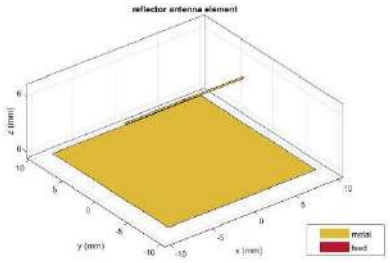
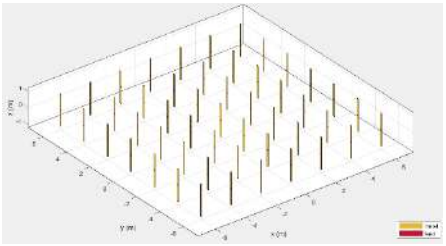
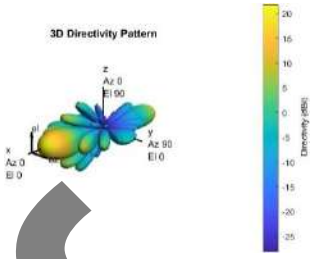


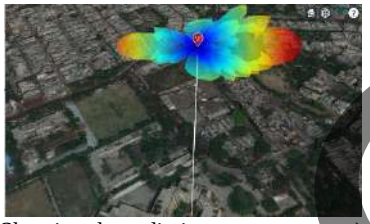
FIGURE 3 a). Reflector Backed Dipole Antenna



b) Showing 7× 7 Uniform Rectangular Array of Reflector Backed Dipole Antenna



c) Showing the radiation pattern from all the array elements



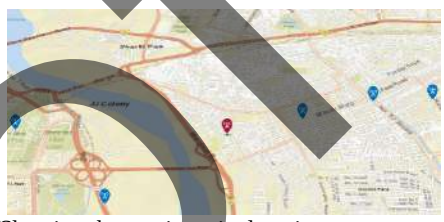
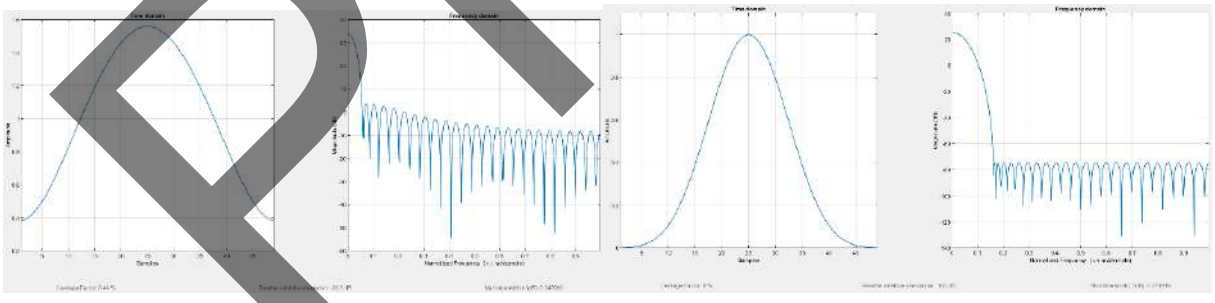


FIGURE 4 a). Showing the transmitter placed at Ambedkar Institute with height 169 meters

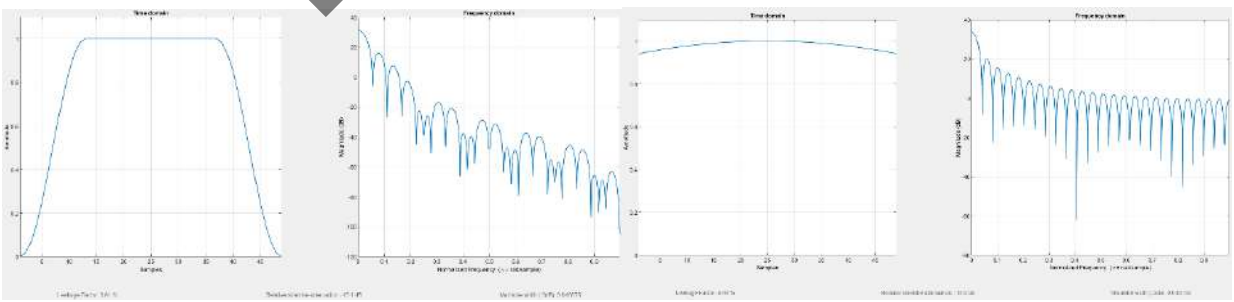
b) Showing the radiation pattern at transmitter site

c) Showing the receiver site location

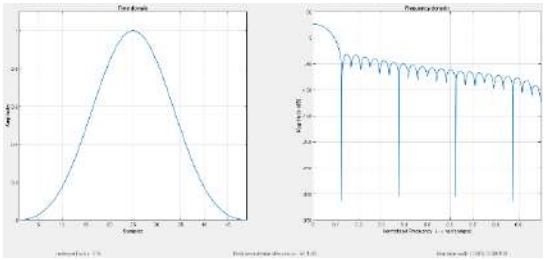
An array of five receiver sites is considered using the latitude and longitude of the sites taken from Google Map as shown in figure 4c. These are the sites of interest which possess the access of the coverage from the transmitter site. These five sites include monument, hospital, temple, marketplace and college area to visualize the application of Smart Antenna. The names for these sites include ***Red Fort, Shri Ram Singh Hospital, Raghunath Temple, Pusta bazar***and ***Northern India regional council of ICAI.***The corresponding latitude and longitude of the receiver sites include (28.656311, 77.241079) of Red Fort, (28.660581, 77.287640) of Shri Ram Singh Hospital, (28.657961, 77.277826) of Raghunath Temple, (28.647140, 77.254341) of Pusta Bazar and (28.660942, 77.295757) of Northern India regional council of ICAI. The array of all receiver sites is formed with each receiver having a sensitivity of -75dBm.



a) **b)**



c) d)



e)

FIGURE 5. Showing the Time and Frequency domain representation of **a)** Taylor Window, **b)** Chebyshev Window, **c)** Tukey Window, **d)** Kaiser Window, **e)** Blackman Window

The beam is scanned by applying the taper for a range of angles. For each angle, the ***antenna updates its radiation pattern*** over a sweep angle of -20° to 20°. The windowing techniquesare used for tapering the beam with the given sweep angle. Figure 5 includes the time and frequency domain representation for all the above-mentioned windows. Finally, we update the radiation pattern of the transmitter using the weights assigned by each of the windowing technique. This approach of beam produces different radiation patterns then the physically rotating antenna. We also define the three signal strength levels in red, yellow and green color as shown in figure 6a. The red color shows the maximum signal strength while the yellow color shows medium signal strength and the green color shows weak signal strength. The received power includes the total transmitted power from the Uniform Rectangular Array. Hence, we finally display the coverage map out to 6000 meters or 6 kilometers. The results show that there is no coverage on the transmitter site and there are a couple of coverages along the bore sight direction. The radiation pattern provides us an understanding of how the antenna power projects onto the map locations around the transmitter. Figure 6 will depict the power corresponding to each receiver site with the maximum coverage area of the transmitter site. Once, we receive the coverage area our target is to map maximum receiver sites in the same coverage area only for which we apply the same algorithm (taper for range of angles) discussed above with the steering vector. The algorithm will work number of times unless the transmitter gets the maximum receivers in their coverage area site. This will assign a sweep of angles taper from the steering vector. Once the transmitter gets maximum receiver in the coverage area, the algorithm will automatically be stopped, and the intermediate and final images are shown. Hence, we develop the concept of adaptive beams forming with the help of the transmitter from the above. The similar concept can be placed in the radar system to detect the target by sweeping for a range of angles. It is not always mandatory that the pulse send over the target should include the target in the very first time. Hence, the radar system first identifies the target by scanning over a beam for many sweep angles and then only the range can be estimated.

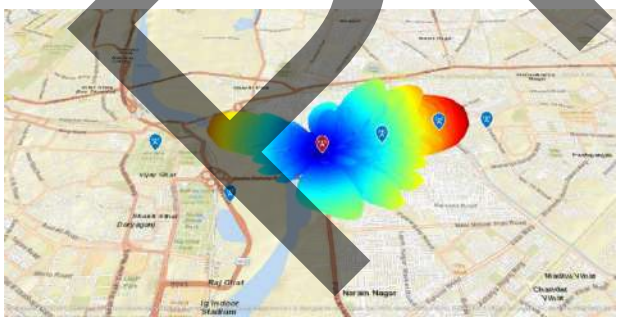


FIGURE 6 a). Showing the radiation pattern of the transmitter in respect to the receiver site

b) Showing the last sweep of the beam by the transmitter to finally detect our receiver

For calculating the complexity of different windowing techniques, we plot a bar graph as shown in figure 7. From the graph, Taylor window converges at much faster rate than the other windowing techniques used for tapering the beam while the Blackman window converges the least amongst all. This is because of the sidelobe cancellation property.

CONCLUSION AND FUTURE WORK

We have designed a URA of RBDA antenna. We analyze the radiation pattern and apply different windowing techniques in order to get the weights for the beam and made a sweep in order to find the maximum coverage.

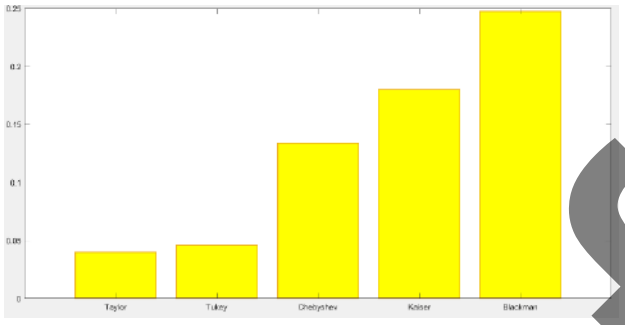


FIGURE 7. Showing the Time Complexity of different windowing technique

The scope future of the work will be in the analysis of Smart Antenna using other more robust adaptivesignal processing algorithms and to apply beamforming algorithms instead of beam scanning algorithms.

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Solar Panel Parameter Measurement and data logging System

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Abstract. Renewable energy sources are a viable option for bridging the power industry's continuous supply shortfall. Solar energy is the most advantageous of all renewable energy resources since it is available worldwide, unlike other geographically limited resources. For this enormous solar system implementation, sophisticated frameworks for remote monitoring of the plant utilizing a Raspberry Pi-based interface are required. Because most of them are located in difficult places, monitoring them from a single location is impractical. The voltage, current temperature, and light intensity are all measured by this system. Raspberry Pi is used to implement the system. This system also includes a data logging system. The solar panel fault detection using a machine learning algorithm is presented in this paper. SVM and KNN algorithms are used to classify the solar panel fault. The suggested approach generates precise results in real-time.

INTRODUCTION

The primary cause for increased power costs is ever-increasing energy consumption and traditional grid reliance, and customers are concerned about rising energy bills. Solar energy is a significant and stable energy source due to various long-term economic benefits. The solar panel's output varies with voltage, current, and environmental conditions. Though the solar energy system doesn't need much maintenance, to avail of the benefits of solar for a long duration, real-time solar panel monitoring is a good practice to ensure that the solar panels are performing to their full potential.

Solar energy is an essential source of renewable energy. Power prediction is a critical feature in grid integration because of its intermittent nature and potential for usage in distributed systems. It is one of the most environmentally friendly energy sources currently available. Due to improvements in photovoltaic (PV) technology, which have resulted in creating more efficient photovoltaic (PV) solar panels and a significant drop in their cost, its market share is fast expanding. However, meteorological conditions such as solar radiation, cloud cover, rainfall, and temperature influence the amount of solar energy generated. This fluctuation hampers the large-scale integration of solar energy into the power system.

Solar panels convert solar energy into electricity for powerhouse lighting, appliances, etc. Solar panels are selected based on a house's needs, the sun's position, and weather conditions. The measurement of the solar panel parameter needs logging to analyze the data in the future. Also, it will help to predict the fault at parameters in the solar system. This project is designed to measure the parameters of solar panels, and the objective is to calculate the voltage, current, power, temperature, and light intensity. The digital display is used to display the values of these parameters. Raspberry Pi is used to measure the analog values of these sensors. The data logger system will be built to store the parameters for further analysis.

LITERATURE SURVEY

Improved measurement technology has an automatic meter reading and an exported energy measuring capacity [1]. An energy metering chip, a PIC microcontroller, and a real-time clock IC are used to make the digital meter. The SIM 900 GSM module transfers the data to a remote server through SMS. The server keeps an account of the incoming message.

The IoT and wearable computing create an advanced application in solar PV plant monitoring [2]. It has been reported that IoT has become a forceful medium to connect roads, streets, houses, and society. Hence, there is an immense possibility of using IoT and miniaturizing the computing system for a safe and cost-effective solar power distribution. Fast data acquisition from the field is an essential characteristic of monitoring devices. Raspberry pi is one of the best devices for data acquisition. Raspberry is an electronics device with built-in RAM, ROM with Digital

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and analog inputs, and an output pin for reading and writing data. The task computation speed of raspberry pi is 30-40 times faster than Arduino. The theme of the present work is a solar PV plant monitoring system by raspberry pi module and an intelligent display of daily usage of power production. An IoT-based system has been successfully integrated into the physical world with a computer system as far as solar PV plants' production of power is concerned.

A control system with a digital signal processor (DSP) and human-machine interface (HMI) has been developed [3]. A practical application of DSP and HMI has been implemented in remote sensing applications using a proper interface. A solar PV module connected to a single-phase utility grid through an inverter is considered. A wireless sensor network architecture (WSN) is introduced for a reliable, error-free, and robust measurement of the parameters of solar PV cells. A ZigBee protocol based on the Duplex digital system has the IEEE standard for wireless personal area network (WPAN) based on the monitoring system.

In [4], a hybrid monitoring system has been adopted wherein solar, and wind power system monitoring is via Advance Virtual RISC based Microcontroller (AVR μC). Three parameters have been monitored: Wind speed, PV temperature, and solar irradiation. The proposed system could be a replacement for a thermometer, pyranometer, and anemometer. The suggested data collecting approach has the benefit of being able to interface with the SCADA application. The applications discussed in this article give a vital understanding of environmental circumstances that may be used to operate a hybrid power system efficiently. The data acquisition system described in the article is checked instead of standard measuring instruments. The errors in the evaluation are below 5%.

Discussions of PV monitoring issues are found in [5]. Remote measurements and monitoring are done for PV properties such as open-circuit voltage, short-circuit current, electricity, and energy generation. The state of the connections, switches, and wire coatings that operate as time increases stability are associated with the lack of monitoring criteria. More comprehensive research will likely guide accelerated development tests to achieve a more comprehensive PV system.

This study [6] discusses assessing grid power efficiency in small-sized photovoltaic and low voltage networks. The examination will be conducted using the Power Quality Monitor System (PQMS). For four months, the 200ms data is kept on the server. The PQMS's PQ database allows for a thorough analysis of PV's impacts on the local channel.

A study is done [7] on monitoring and manipulating the data and controlling the operation of a solar PV system. This proposed innovative system function is reported to realize in real-time. In this paper, the author addresses the solar panel problems related to inflexibility, poor manageability, mean time to repair, and difficulty in maintenance. To overcome the issues, the intelligent system's practical design and development are proposed to monitor, control, and administer the solar photovoltaic (PV) system. The intelligent integration is made feasible by combining IoT, M2M-based technologies, IPV6 via a low-power personal area network (6LowPAN), and a WSN. This system helps monitor solar energy production in terms of voltage and current in three decimal places. The machine-to-machine technology allows the online control of solar PV systems. Hence, an automatic setting for panel rotation towards the sun in receiving maximum radiation intensity could be remotely controlled. Real-time data saving is possible, and data can be saved using cloud computing and IoT techniques.

According to Purusothaman et al. [8], the emphasis is on DG agents, grid agents, and Mu agents. DG agents include, among others, load, storage, grid, and distributed energy resources (DERs). The Mu agent achieves communication between the DG and higher-level agents, like the control agent. An Arduino microcontroller was used to build the system.

Ersan Kabalci et al. [9] introduce a close monitoring infrastructure for wind turbine and solar panel arrays in a sustainable energy production system. Each renewable energy source's current and voltage statistics are used to build the monitoring platform. The created sensor circuits measure the relevant quantities, which are then processed by a Microchip 18F4450 microcontroller. The processed parameters are subsequently sent by USB to a personal computer (PC), where they are recorded in a database and immediately visible in the system. The visual interface of the monitoring software is configured to handle the collected data and look at each measurement's daily, weekly, and monthly values separately.

Jiju K. et al. [10] discussed how they developed an online monitoring and control system for dispersed Renewable Energy Sources using the Android platform (RES). Using this technique, an Android tablet or phone's Bluetooth interface is connected to the digital circuitry of the Power Conditioning Unit (PCU).

According to Goto, Yoshihiro, et al. [11], a system for managing and remotely monitoring telecoms power plants was created and put into use. The system operates and manages more than 200,000 communication power plants, such as rectifiers, inverters, UPSs, and air-conditioning facilities. One of the system's characteristics was integrating management and remote monitoring activities into a single system and improved user interfaces that included information and communication technologies like the internet.

Alexander Suzdalenko and Ilya Galkin, among others [12], Use load disaggregation into separate appliances, a non-intrusive load monitoring technique, to identify the issue when several local renewable energy producers are linked to the same grid. These appliances may be incompatible with shifting loads.

PROPOSED SYSTEM

This section elaborates on the proposed solar panel parameter measurement and fault detection system.

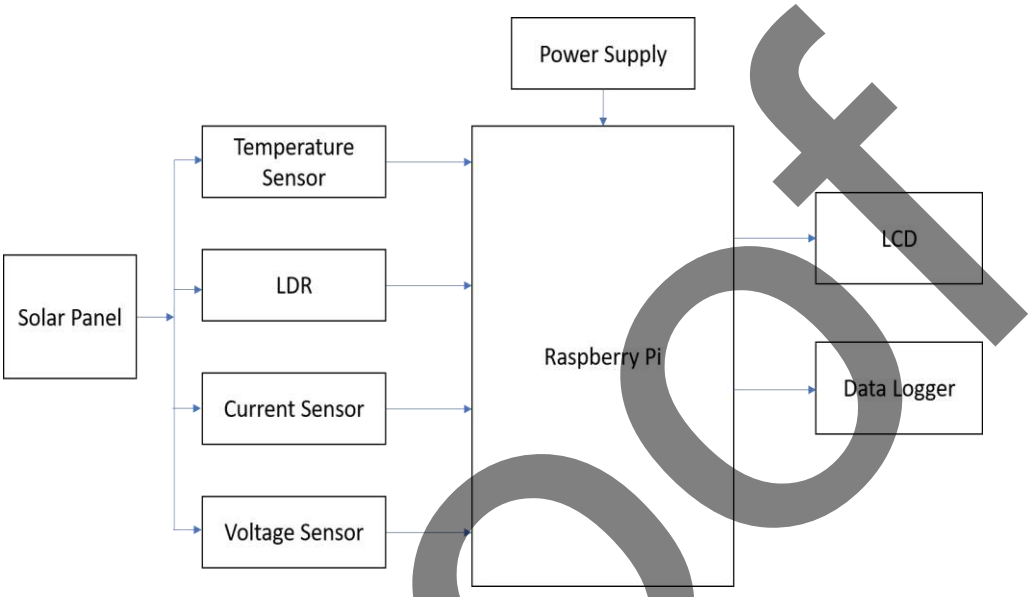

FIGURE 1. Block diagram of the proposed system

In this system, Raspberry pi is the main component. The temperature sensor is mounted on the solar panel to measure the temperature at the current time. The LDR is used to gauge the brightness of the light. Real-time measurements of the solar panel's output current are made using a current and voltage sensor. The Raspberry Pi monitors these parameters. The RTC is used to get the accurate timestamp of the time. The data logger system stores the data in the raspberry pi's memory card, which shows all the temperature, light intensity, current, and voltage at a particular timestamp.

The system is mounted on the solar panel, and the voltage, current, temperature, and light intensity are measured using ZMPT101B, ACS712, LM35, and BH1750 sensors, respectively. Raspberry Pi processes the parameters. The collected data is logged in the excel sheet, which can be analyzed later. The data is logged into the system secondswise.

PREDICTION OF THE FAULT IN THE SOLAR PANEL USING A MACHINE LEARNING ALGORITHM

The block diagram of the machine learning-based solar panel fault detection system is shown in Fig.2.

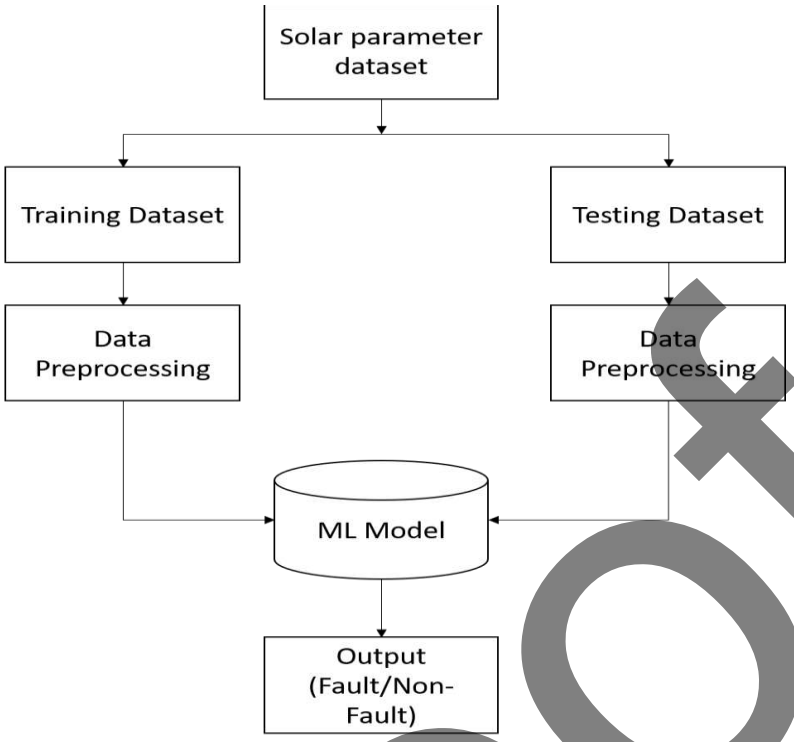

FIGURE 2. Machine learning-based solar panel fault detection system

Below is a detailed explanation of the machine learning-based solar panel fault detection.

Dataset preparation

In this system, the dataset of the solar panel's voltage, current, and temperature for one-month data is considered. The faulty and non-faulty data is collected from a real-time system. The faults are generated in the solar to create a faulty dataset. The sample data used in this system is shown in Fig. 8.

Temparature	Current	Voltage	Label
37.22342857	3.905859375	32.20703125	0
37.22342857	3.905859375	32.20703125	0
37.22342857	3.905859375	32.20703125	0
37.22342857	3.905859375	32.20703125	0
37.22342857	3.905859375	32.20703125	0
37.22342857	3.905859375	32.20703125	0
37.22342857	3.905859375	32.20703125	0
37.22342857	3.905859375	32.20703125	0
1.562881563	0.103125	422.4	1
0	0.000805664	3.3	1
0.012210012	0.000805664	3.3	1
0.012210012	0.000805664	3.3	1
0.012210012	0.000805664	3.3	1
0.012210012	0.000805664	3.3	1
0.012210012	0.000805664	3.3	1
0.012210012	0.000805664	3.3	1

FIGURE 3. Machine learning-based solar panel fault detection system

In Fig.3, the faulty dataset is labeled by one, and normal data is labeled by 0.

Data Preprocessing

Handling missing data is one of the activities involved in data preprocessing. Our machine learning model may run into serious issues if our dataset has some missing data. As a result, the dataset contains missing values, which must be handled. In this approach, missing values are handled by computing the column's mean and inserting it where the missing value should go. Training and testing the data using the Machine Learning algorithm

In this system, the SVM and KNN are used to train the network. A detailed explanation of the machine learning algorithm is given below.

SVM

The SVM algorithm is ideal for locating the hyperplane between two or multiclass classes. SVM is a supervised machine learning method [13]. Testing and training are two phases in a type of directed learning. The SVM classifier uses a linear function to categorize the image.

$$f(x) = W^T X + b \tag{1}$$

Where X is the training samples

W is the allotted weight,

while b is the bias or offset.

Linear and nonlinear categories were separated using SVM in classification. The input sequence is transformed into a higher dimensional space using the linear SVM classifier instead of the nonlinear classifier. Hyperplanes may be used to study data that can be separated linearly. In contrast, kernel functions like higher-order polynomials can be used to investigate data that cannot be separated linearly carefully. Radial Basis Function (RBF), Linear Kernel Function, and Quadratic Kernel Function are just a few kernel strategies that make up the SVM classification algorithm. Two samples, x, and x', are applied as extracted features in some input space using the RBF kernel,

$$K(x, x') = \exp\left(\frac{||x - x'||^2}{2\sigma^2}\right) \tag{2}$$

As distance increases, the kernel function's value falls and fluctuates between zero and one (when x = x').

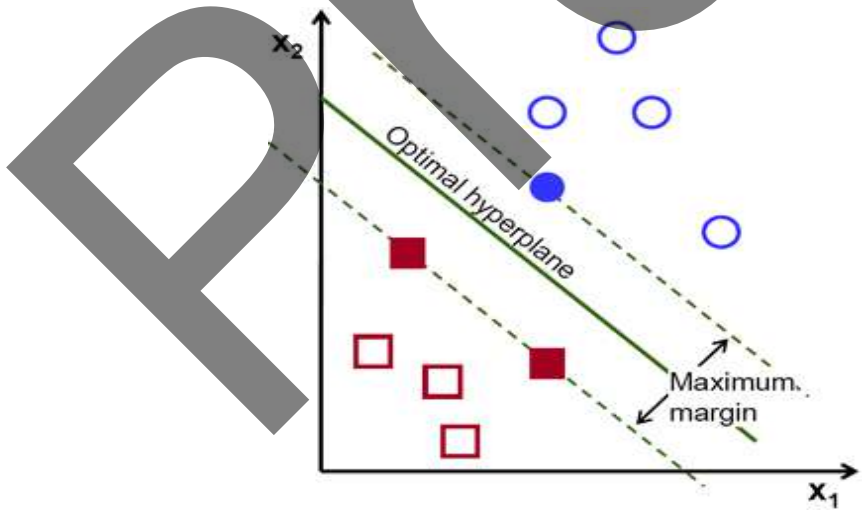

FIGURE 4. Optimal hyperplane margin

KNN

KNN is a straightforward and reliable classification method. The testing feature vector in this classifier is categorized by locating the k closest training neighbor vectors. This approach separates the training and testing data

vectors by Euclidean, cityblock, cosine, and correlation distances. Given below is the Euclidean distance between the training and testing vector.

$$d(a,b) = \sqrt{\sum_{i=1}^{n}(a_i - b_i)^2} \quad (3)$$

The testing vector is given the label of the feature vector with the least distance.

As a result of the feature extraction from the training and test sets, we obtain various dimensions in space. The extracted feature values are used to calculate the coordinates of each characteristic in each dimension, resulting in a collection of points in the space. Then, using a proper metric, we can relate the distance between two different locations in space to how similar they are to one another.

To identify which points from the training set are significantly similar to the point inspected while choosing the class to estimate for a new instance, the applied approach chooses the k data points closest to the new observation. From there, the most frequent class is determined. The k Nearest Neighbor algorithm functioned in this way.

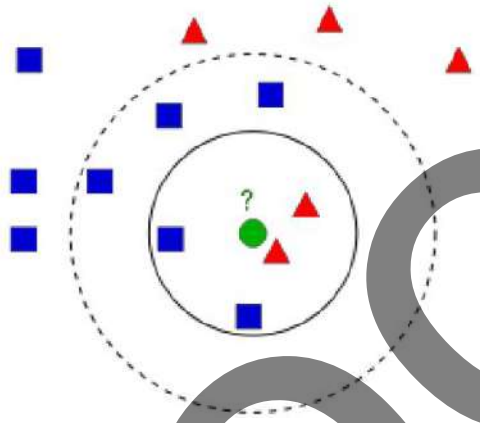

FIGURE 5. Classification of query image through KNN classifier

Two classes are depicted in Fig. 5 by Blue Squares and Red Triangles. The feature set now includes the new testing functionality shown by the color green. Using k nearest neighbors, the testing feature was categorized into the appropriate class by applying the label of more excellent majority neighbors.

RESULTS

The hardware interfacing diagram of the proposed system is shown in Fig. 6.

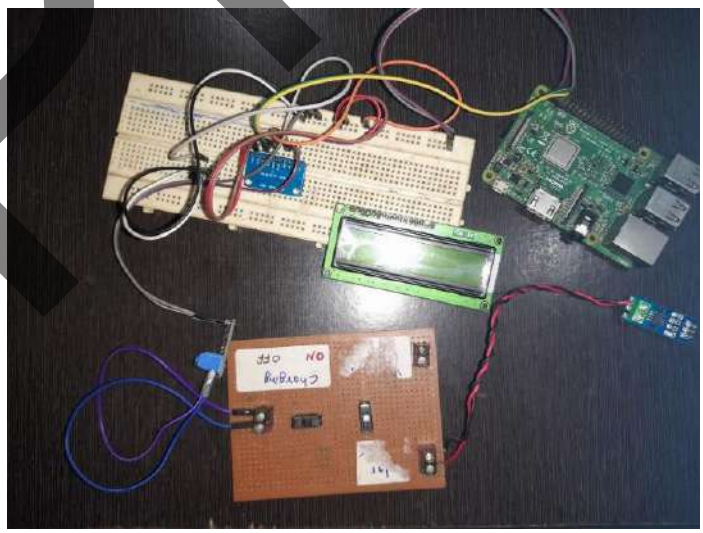

FIGURE 6. Hardware interface model

The logging output of the system is as shown below in Fig. 7.

	A	B	C	D
1	Time	Temparature	Current	Voltage
2	12-05-2022 00:55:20	37.22342857	3.905859375	32.20703125
3	12-05-2022 00:55:21	37.22342857	3.905859375	32.20703125
4	12-05-2022 00:55:22	37.22342857	3.905859375	32.20703125
5	12-05-2022 00:55:22	37.22342857	3.905859375	32.20703125
6	12-05-2022 00:55:23	37.22342857	3.905859375	32.20703125
7	12-05-2022 00:55:24	37.22342857	3.905859375	32.20703125
8	12-05-2022 00:55:24	37.22342857	3.905859375	32.20703125
9	12-05-2022 00:55:25	37.22342857	3.905859375	32.20703125
10	12-05-2022 00:55:26	37.22342857	3.905859375	32.20703125
11	12-05-2022 00:55:27	37.22342857	3.905859375	32.20703125
12	12-05-2022 00:55:27	37.22342857	3.905859375	32.20703125
13	12-05-2022 00:55:28	37.22342857	3.905859375	32.20703125
14	12-05-2022 00:55:29	37.22342857	3.905859375	32.20703125
15	12-05-2022 00:55:29	37.22342857	3.905859375	32.20703125
16	12-05-2022 00:55:30	37.22342857	3.905859375	32.20703125
17	12-05-2022 00:55:31	37.22342857	3.905859375	32.20703125
18	12-05-2022 00:55:31	37.22342857	3.905859375	32.20703125
19	12-05-2022 00:55:32	37.22342857	3.905859375	32.20703125

FIGURE 7. Logging Reading of the proposed system

The machine learning-based solar panel fault detection system results are evaluated using accuracy. The accuracy of the SVM and KNN algorithm is tabulated in Table I.

TABLE 1. Dataset Distribution

Column Header Goes Here	Parameter	Accuracy
SVM	Rbf	0.824
	Polynomial	0.649
	sigmoid	0.527
KNN	K=3	0.9631
	K=5	0.9585
	K=7	0.9885

Table I shows that the KNN algorithm with k=3 shows the highest accuracy of 0.9631 while SVM with RBF kernel shows 0.824.

CONCLUSION

Renewable Energy technology is one recommended approach to reducing environmental impact. Renewable energy must be used and managed due to the frequent power disruptions. The user is guided through the procedure of tracking renewable energy usage. This is a cost-efficient method. The system monitors the voltage, current temperature, and light intensity. The system is implemented using a Raspberry Pi. The data logger system is also employed in this system. The proposed method is implemented in real-time. The approach proposed generates exact findings in real-time. The solar panel fault detection system using a machine learning algorithm, i.e., SVM and KNN algorithm, is presented in this paper. KNN algorithm with k=3 outperforms the SVM algorithm.

In the future, the solar panel fault detection system can be extended by creating extensive data and implementing the deep learning algorithm to improve the accuracy and robustness of the system.

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Smart Voting Through Face Recognition

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Abstract. Voting system plays an important role in any democratic country. Vote means to elect the best political pioneer.InIndia, currently two types of voting systems are depleted, which are secret Ballet paper and Electronic Voting Machines(EVM), but both of them have severalrestrains. The current voting system is **jeopardizing,** voters visits poolingbooth and stand in long line up to cast their votes, because of which there are possibilities that many people miss their chance of voting. Additionally, social gathering isn't much preferred in this COVID-19 situation. Voters who are ineligible may also use fraudulent methods to cast their ballots, which may result in hardship.. Therefore, in this project, we suggest a voting system that is efficient and has three layers of security. The verification of the voter's unique identification number (UID) comes first, then the verification of their election identification number (EID), and finally the verification of their face, which is the highest level of security.

INTRODUCTION

An election is a procedure through which individuals can communicate their political sentiment. They express this conclusion by open democratic to pick a political pioneer. The political race is positively an imperative mainstay of the majority rules system. This is because; Election guarantees that the administration is of the individuals, by the individuals, and for the individuals. At present in India, two kinds of strategies are utilized for casting a vote. The primary method is paper ballot[1], which uses masses of paper, and the second solution is the EVM, which has been in use since 2003 and involves a lot of labor[2].The current election procedures are time-consuming and insecure. The majority of people forgo the opportunity to cast their ballot because voters must go to designated locations, such as polling booths, and wait in long lines. Additionally, voters who are not eligible to cast a ballot can still do so using questionable tactics that may result in legal issues. That is why it is necessary to offer a voting system that is more secure and dependable. Therefore, we developed an online voting system that is safer than the current one. Face recognition technology is used in this suggested business venture to identify the correctindividual. There are three distinct security levels. The proof of the UID [3] is the first level, the verification of the EID [4] is the second layer, and facial recognition is the third tier. Due to its simplicity of usage and affordability in terms of computer resources, the Eigen face algorithm is employed for face recognition. The use of a novel approach for each voter has significantly increased the security level of the framework.By implementing face recognition in the application, which has the option to determine if the client is a validated client or not, the validation of the client in the framework is improved. In order to gather information about the situation, cameras are a crucial component of security [5]. This system is superior to conventional voting procedures in that it prevents voters from casting ballots in unfavourable ways and gives them the option of voting remotely.

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NECESSITY

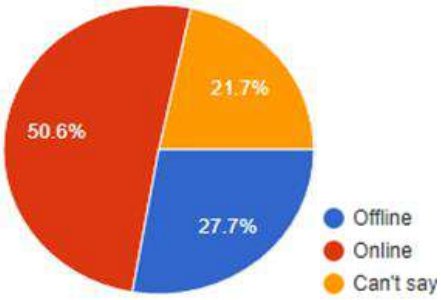

FIGURE 1. Graph shows response of survey conducted on a group of people (Online vs Offline voting).

Table 1. Following table shows the reason for people to choose online voting.

Reason	Percentage
Avoiding gathering during Covid	31.8%
Busy schedule	18.2%
Inconvenient place	15.2%
Offline Registration problem	15.2%

In our research more then 50% people preferred onling mode for over offlineamong which more then 31%choosed online because of covid pandamic, 18.2% because of busy schedule and more then 30% because of inconvience in reaching the polling booth or offline voting registrations problems. Our proposed method would serve the following purpose:

1) Maintain the integrity of Election Commission.
2)Flexibility in voting; can vote online from any place.
3) Make voting more secure.
4) Reduce the voting cost.

DATA

We have used the Face Recognition dataset [6]. Total it comprises of 2563 distinct objects with over 50 different images per subject. There are certain variations in facial characteristics, such as the presence or absence of glasses, as well as facial expressions like open or closed eyes and smiling or frowning faces.Thumbnail of few images are shown below. For processing purpose images are reduced to gray scale.

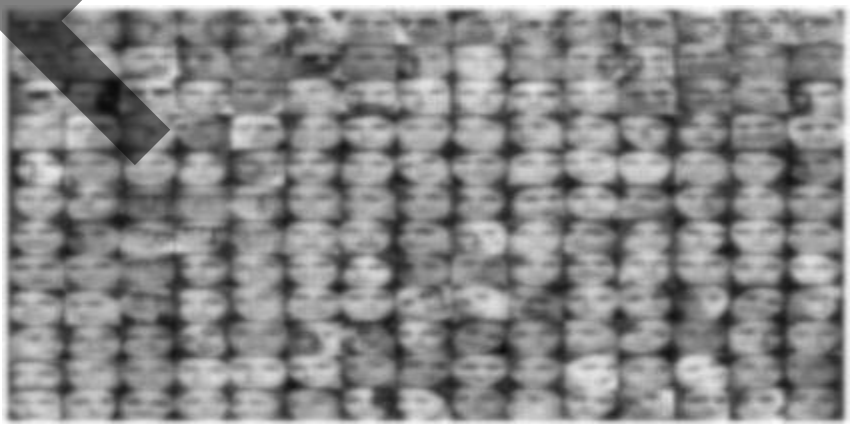

FIGURE 2. Thumbnail of few images used for training dataset

PROPOSED SYSTEM

The system is designed in such aaway that it is operated by two operators, the election controller and voter.

"Candidate Authentication involves three stages. First is verification of UID in which voter has to mention his UID (aadhar card number). Second step involves verification of EID in which voter has to mention his EID (voter card Id). Third and the primary stage consists of face recognition where the image processing algorithm is appled to remove noise then after face recognition algorithm is applied.If the candidate's details matches with any details stored in database then the candidate is permitted to vote. We are using two algorithms for face authentication the first one is face recognition through Eigen face algorithm and the second is face recognition through CNN.To operate, CNN first obtains the picture, assigns it a weight depending on the various items in the image, and then separates them from one another. Unlike to other deep learning methods, CNN involves a remarkably minimal amount of data pre-processing. CNN's ability to train its models using straightforward methods, which allows it to understand the characteristics of the target object[7], is one of its main advantages. Convolution layers, pooling layers, and fully connected layers are just a few of the structural components that CNN uses to automatically and constructively learn spatial hierarchies of information .The basic diagram of neural processing unit is depicted in (fig 3).

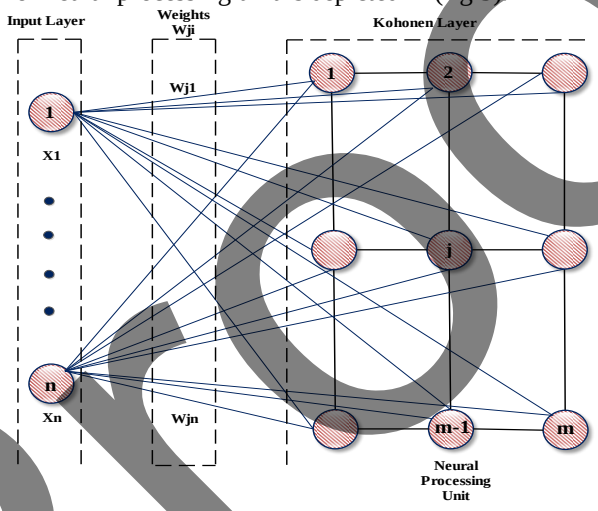

FIGURE 3. Basic Diagram of Neural network and Neural Processing Unit

EIGEN FACE ALGORITHM

A schematic diagram for working of face recognition is shown in (fig 4.)

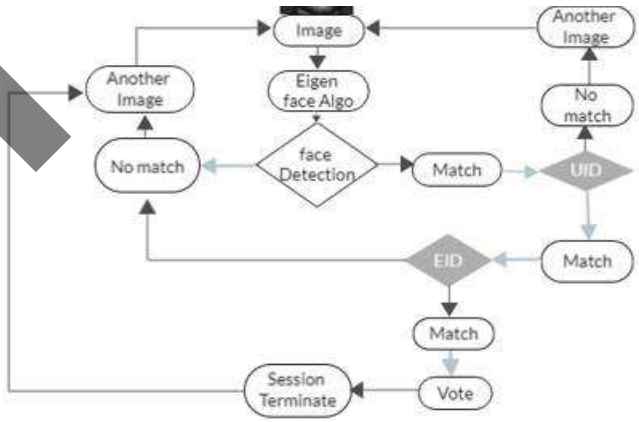

FIGURE 4.working of eigen face algorithm

Following an appearance-based method for face identification is the basic idea behind the Eigne face algorithm [8]. It is used to encrypt the unique photos of individual shots and to limit the variability in a group of facial images. The dataset is then thoroughly compared to the encoded images. The Eigen faces serve as the foundation for each and every image needed to build the covariance matrix. The condensed, reduced collection of basis photos serves as a representation of the original training images, generating dimension reduction. The classification is accomplished by contrasting the representations of faces in the basis set.

I. Face images are mapped onto a feature space called "Face Space" that optimally encodes the variation among recognised face images.

II. The "eigenfaces," which are the eigenvectors of the set of faces, define the face space.

WORKING OF EIGEN FACE ALGORITHM

Procedures for Face Recognition

1. To fully recognise every facial characteristic for every new person, photos are taken from various viewing angles to create the training data set.
2. Next, using openCV and the grayscale property, the images in the training set are reassembled and rebuilt such that they have the same proportions and sizes in pixels.
3. In order to improve the features, we make the image more contrasty, which adds another stage to the process.
4. These are then combined to create an Eigenvector.

Principal Component Analysis (PCA) is used by the Eigenfaces technique to determine Eigen values. By eliminating and integrating the common features of the data, PCAlessen the dimensionality of the data and produces Eigen space. The Eigenvectors in this Eigen space then aid in the mathematical depiction of the different patterns.

PCA REPRESENTATION

Computation of Eigen faces

1. Determine the average face: v
2. Gather the differences in matrix A (M by N), where M is the number of pixels and N is the number of pictures, between the training photos and the typical face.
3. The Eigen faces are given by the eigenvectors of the covariance matrix C (M by M).

$$A = [u_1^1 - v, \ldots, u_n^1 - v, \ldots, u_1^p - v, \ldots, u_n^p - v]$$

M is typically large, therefore this operation would take a while.

$$C = AA^T$$

Computation of C's eigenvectors

There will only be N-1 meaningful eigenvectors if the number of data points is less than the dimension (N<M).

We can compute the eigenvalues and accompanying eigenvectors of a much smaller matrix L instead of directly computing the eigenvectors of the larger matrix C. (N by N).

$$L=A^TA$$

if λi are the eigenvectors of L then A λi are the eigenvectors for C.

·The eigenvectors follow the associated eigenvalues in descending order.

·Eigen faces are used to represent facial images [8].

·The linear combination of the Eigen faces can be used to represent both the training face images and the new face images.When we have a face imageu:

$u=\sum_i a_i\phi_i$

Since the eigenvectors are orthogonal:

$a_i=u^t\phi_i$

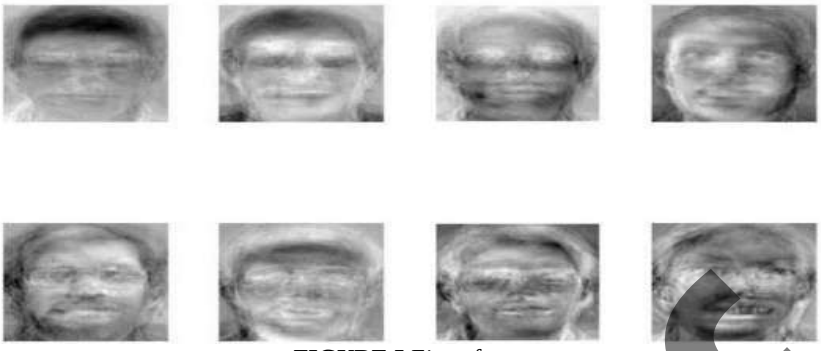

FIGURE 5. Eigen faces

RESULT

Data used here is from kaggle face recognition dataset. Facial images of 2563 persons each with 50 views are used.

-Training set contains 2563×40 images.

-Test set contains 2563×10 images.

Best recognition rates

Training set-96%

Test set-93%

FIGURE 6. Log in Interface with First level SecurityLog in Interface with First level Security

FIGURE 7. Login Interface with third level security Login interface after successful voting

CONCLUSION

By integrating this function with our current voting system, we might increase its capabilities and make it more secure and free from fraudulent voting. Face recognition has long been a more reliable and secure form of authentication.Inside this study, we have suggested a novel technique to enhance the vote process.The voters who are not authorised to vote can be easily identified because this proposed method has three levels of protection. We can prevent phoney votes during the election commission by using the facial authentication approach to identify fraudulent voters. By logging into this smart voting system through the internet, voters can cast their ballots from any location. Since internet access is used for each operation, the government only needs to make one investment.Data backups are also possible because the data will be kept in a central source, making it always available. A smart voting system provides results that are updated every minute. Less resources and workforce are needed.It is possible to increase the security of Blockchain technology.

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MODELING AND ESTIMATION OF SOLAR PHOTOVOLTAICS THERMAL PANEL SYSTEM

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Abstract-In order to generate both power and heat from a single solar panel, photovoltaic thermal (PVT) devices have been developed. A state-space model that has been specifically created is used to determine the design technically. This model, unlike other models that have been presented, takes thermal capacitances into account in the thermal equivalent circuit. For the proposed PVT system, the energy balance equation technique will have been theoretically calculated. The suggested PVT system's output will be estimated using the Kalman Filter technique. The non-linear behaviour of environmental components makes predicting the output of renewable energy systems problematic. With grid-connected systems, the solar plant's day-ahead output prediction enables effective decision-making. use the state-space model established for the PVT system. The non-linear behaviours of the environmental elements, estimating the output of renewable systems is a difficult problem. The day-ahead output estimation of solar plants aids in taking appropriate measures with grid-connected systems. Using the state-space model created for the PVT system. The simulation platform is MATLAB Simulink.

INTRODUCTION

With the acceleration of industrialization, energy demand is increasing day by day. As a result of, energy sources such as coal, natural gas, LPG and kerosene have deteriorated, causing serious environmental pollution. Photovoltaic (PV) cells can convert solar energy into electrical energy. Photovoltaics is expected to pave the way for the emergence of a new energy service industry where technology needs to meet the demand for services such as energy management, backup or emergency power, environmental benefits, fuel diversity and more. I am. [1]. The specific electrical conversion efficiency of PV cells ranges from 10-20% of commercially available silicon cells to about 40% of multi-junction solar cells [2]. The remaining solar radiation is converted to heat and released into the environment. As a result, most of the solar energy is lost as heat. This heat can be dissipated by using a heatsink material or by directing liquid or air to the back of the PV module to cool the cell. By using a heat exchanger to collect thermal energy in addition to electrical energy, a photovoltaic heat (PVT) system was born. PVT systems can generate more electrical and thermal energy than stand-alone PV modules and solar collectors and require less space. Kern and Russel [1] proposed the first PVT collector. Since then, many researchers have conducted extensive research on the PVT system.

TABLE 1. PV Panel Specifications

Sr.No.	PV module	Specification
1	Type	Poly-crystalline Si
2	Nominal power	300 W
3	Unclosed circuit voltage	46.3 V
4	Closed circuit current	8.77 A
5	power output voltage	36.7 V
6	Power output Current	8.17 A

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Above table shows the typical values of solar photovoltaic panel specification with nominal power rating open circuit voltage, short circuit current, output voltage and current.

SOLAR PVT SYSTEM DESCRIPTION

Depending on the technique used, PV modules can have different layers. Yingli Solar has manufactured the YL300P-35b polycrystalline PV module used in the proposed work. The specifications of the solar cell module are shown in Table (1). This PV module is used to build the PVT panel. That is the focus of this research. As shown in the figure, the PVT system consists of five main layers: glass cover, solar cells, EVA, Tedlar , cooling channels and insulation (1). Three of the first layers are attached to a metal frame. These multiple levels are described below.

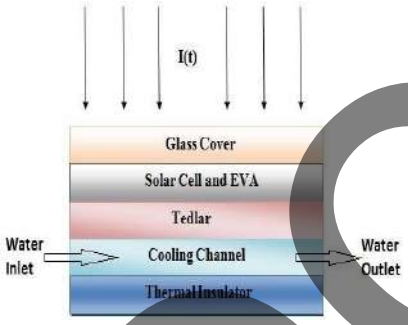


FIGURE 1. PVT panel layer diagram

Glass cover: The top cover of the PVTpanel is made of tempered low iron glass, toallow maximum solar radiations to pass through to the cells. The thickness of the glass layer is 0.003*m*.

Solar cell and EVA: This panel employs polycrystalline silicon cells. To establish adhesion between the solar cells, glass cover, and Tedlar, an encapsulant is employed. The most prevalent encapsulant substance is ethyl vinyl acetate (EVA). A solar cell has a thickness of around 0.0003m.

Cooling channel: The cooling channel is the fourth layer of PVT panel. The layer isgap in which cooling water will flow. Thegap is created using acrylic sheet. This acrylic sheet is placed on the backside of the PV panel as shown in fig A gap of 0.006 m maintained between Tedlar and acrylic sheet.

Thermal Insulator: It is 0.006m thick acrylic sheet which is highly resistant toweathering. It also acts as a thermal insulator . Holes of diameter is 0.007 m are provided in the acrylic for water in let and outlet. An epoxy sealant is used to paste theacrylic sheet and the frame.

THERMAL EQUIVALENT CIRCUIT MODEL

The RC network is formed for every layerin the solar PVT systems. A small value thermal capacitance neglected to simplify the model. In this model, input solar irradiance incident on the panel is considered to be a current source ($Ip = I.A_C$). The dynamic stateequations are derived by applying nodal analysis.

Rth, and thermal capacitance, Cth. These factors were utilised to characterise how heat was transported in the PV layers via conduction. Thermal resistance is a measure of a material's resistance to heat passage and is expressed as:

$$Rth = 1/KA$$

$$\text{Cth} = \rho \; cp \; A \; t$$

The RC network is formed for every layerin the solar PVT systems. A small value thermal capacitance neglected to simplify the model. In this model, input solar irradiance incident on the panel is considered to be a current source ($Ip = I.A_C$). The dynamic stateequations are derived by applying nodal analysis at different nodes available in the system RC equivalent circuit.

The equivalent thermal RC network circuitis formed for the solar PVT system, as shown in figure. The current source Ix represents the water circulation through the water channel at theback side of the PV panel. The formula for Ix is shown in equation.

$$Ix = m^{\cdot} Cp(Tw - Tin),$$

The C_p represents the specific heat of water.

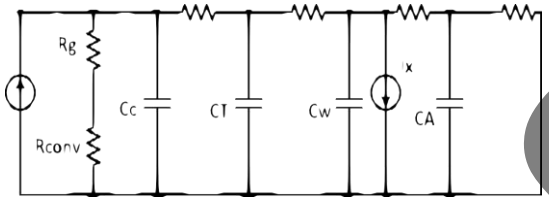


FIGURE 2. Thermal Model of Solar PVT

For the construction of the statespace model of PVT points A, B, C, and D, as shown in figure In the following equations, the thermal equivalent voltage drop across the resistance is represented by the respective temperatures (states).

X_1, X_2, X_3 ,& X_4 are the states.are the temperatures of the solar cell, tedlar, water and acrylic respectively. The 4 state equations are given in equations and the space model equations for the system are mentioned in the equations.

$$\dot{x1} = \left(\frac{Ip}{Cc}\right) - \left(\frac{x1 - x2}{RcCc}\right) - \frac{x1}{(Rg + Rconv)Cc}$$

$$\dot{x2} = \left(\frac{x1 - x2}{RcCT}\right) - \frac{(x2 - x3)}{RTCT}$$

$$\dot{x3} = \left(\frac{(x2 - x3)}{RTCw}\right) - \left(\frac{x3 - x4}{RwCw}\right) - \frac{Ix}{Cw}$$

$$\dot{x4} = \left(\frac{Ip}{Cc}\right) - \left(\frac{x3 - x4}{R2CA}\right) - \frac{x4}{RACA}$$

$$\dot{x} = Ax + Bu + Ew$$

$$Y = Cx$$

$xx = [Tc \quad TT \quad Tw \quad TA]\text{^}T$ is the vector containing the temperatures at the 4 nodes of the PVT system. The state matrix A constructed using four-state equations. B is a control matrix. m˙ is the mass flow rate of water, and C is the output matrix. Y is the output vector consists

of Electrical power and Heat power Y = [P Q] T. E is the perturbation matrix acting on the perturbation input I(t). The relationship between Tc and Tw with the electrical power output (P) and thermal output (Q) presented in. The detailed form of the state equation is expressed by:

$$\begin{bmatrix} \dot{Tc} \\ \dot{Tsu} \\ \dot{Tw} \\ \dot{Ta} \end{bmatrix} = \begin{bmatrix} a11 & a12 & a13 & a14 \\ a21 & a22 & a23 & a24 \\ a31 & a32 & a33 & a34 \\ a41 & a42 & a43 & a44 \end{bmatrix} \begin{bmatrix} Tc \\ Tsu \\ Tw \\ Ta \end{bmatrix} + \dot{m} \begin{bmatrix} b11 \\ b21 \\ b31 \\ b41 \end{bmatrix} + \begin{bmatrix} e11 & e12 \\ e21 & e22 \\ e31 & e32 \\ e41 & e42 \end{bmatrix} \begin{bmatrix} I \\ Ta \end{bmatrix}$$

$$\begin{bmatrix} P \\ Q \end{bmatrix} = \begin{bmatrix} C11 & 0 & 0 & 0 \\ 0 & 0 & C23 & 0 \end{bmatrix} \begin{bmatrix} Tc \\ Tsu \\ Tw \\ Ta \end{bmatrix}$$

Thus mathematical modelling of PVT thermal system is done by using the energy balance equation and nodal analysis. According to the energy balance equation, the heat that enters a system at any particular point, or node, must equal the heat that leaves the node plus any heat that is stored. (Heat is stored in thermal capacitances as increased temperature).

KALMAN FILTER ESTIMATION

The Kalman filter (KF) was first developed as a mathematical technique that used an estimator of the predictor-corrector type. When certain presumptions are true, The goal of KF is to lower the estimated error covariance. The state has been estimated at specific times in its initial development. It is well known that the KF can estimate the state vector when the sensor and process are noisy. In solar PVT systems, a variety of structural restrictions and sun irradiation uncertainties affect the output power estimation. It is challenging to mathematically model these dynamics.

The KF is depicted in the subsequent equations. The Kalman filter consists of two phases: prediction and update. A posteriori state estimates are represented by x (n)(-), whereas a priori state estimates are denoted by x (n) (-).

The following are the definition sof a priori and posteriori estimation mistakes.

$$e_{n^-} = x(n) - \hat{x}(-)$$

$$e_{n^+} = x(n) - \hat{x}(+)$$

The error covariance defined by the a priori estimate is thus P(n)(-)=E[e n e (n(-T))] and the error covariance derived using the a posteriori technique is P(n)(-)=E[e n+ e (n+T)].

AN OVERVIEW OF THE ALGORITHM IS PROVIDED BELOW

1. When using nominal values in the system function, the priori state estimate is calculated from system dynamics.

$$\hat{x}(n+1) = f[\hat{x}(n), u(n)]$$

2. The matrix of the previous estimate error covariance is as follows:

$$P(n+1)(-) = \emptyset(n)P(n)(+)\emptyset(n)^T + Q$$

$$\text{where, } \phi(n) = \frac{df}{dx} \; |x(n)(+)$$

3. They can estimate the output a priori using the measurement equation.

$$\hat{x}(n+1)(-) = g(\hat{x}(n+1)(-))$$

4. To reduce the a posteriori error covariance equation, they choose the j * k matrix N as the gain or blending element. It's known as the Kalman Gain. The matrices Q and R reflect the covariance of process noise and measurement noise, respectively.

$$N(n+1) = P(n+1)(-)C^T(n+1)[C(n+1)P(n+1)(-)C^T(n+1) + R]^{-1}$$

$$\text{where, } C(n+1) = \frac{dg}{dx}|\hat{x}(n+1)(-).$$

5. As a result, the posterior state estimate is calculated as:

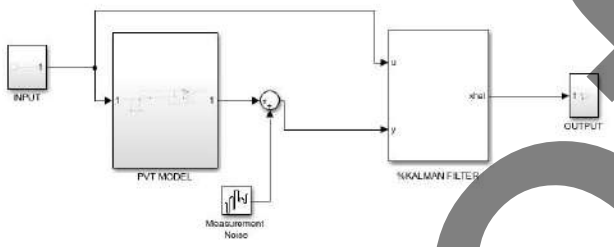
$$\hat{x}(n+1)(+) = \hat{x}(n+1)(-) + N(n+1)[y(n+1) - \hat{y}(n+1)(-)]$$

The selection of N, Q and R was done by trial and error method.

KALMAN FILTER BLOCK DIAGRAM

Below figure shows the simulink block diagram of solar thermal panel system with the output feded to kalman filter.which consist of PVT Model block,process noise,measurement noise and Kalman Filter block.

Where process noise is considered in the PVT model and measurement noise is added in the output of proposed model of PVT panel.

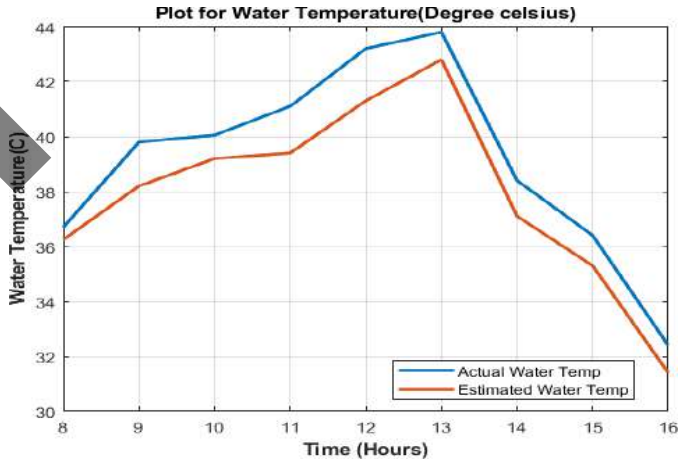


FIFURE 3. Block Diagram of Kalman Filter

Here nominal values are given to the kalman filter.
It is given as,I0 is solar irradiance of 650 W/m^2
Ta0 is ambient temperature of 22 degrees Celsius.
Initial conditions of PVT systemT is given as: X (0) = [41.5 42.5 42.3 42.1] ^ T
This are initial condition for PVT system around 12 p.m. in the afternoon .

RESULT AND DISCUSSION OF OUTPUT

In Pune, India, a novel The experimental setup of a solar PVT hybrid system is created and put to the test. In order to evaluate how well the systems function, a photovoltaic panel system is also placed in conjunction with the PVT system. The temperature was of the PV (Tedlar) and PVT panel's backside is measured using LM-35 sensors, while the temperature of the outflow water is measured using a DS18B20 temperature sensor.



FIFURE 4. Output of Kalman Filter

The output of the proposed PVT system estimated using KF. The new hybrid PVT system is developed and tested experimentally atPune, India location.

The cell temperature and water temperature of the PVT system are estimated using KF, from the cell temperature the electrical power and efficiency is calculated.From the simulated plot, one can conclude that the maximum output can be obtained if outlet water temperature is at optimal value, which is about 51°C. This plot is for a summer the only controllableparameter in the proposed system.

The flow rate of water is kept constant at 0.010 *kg/s*. The water flow rate is kept as low as possible, since the low temperature heat extraction should be in the useful temperature range, such that the heated water can be helpful for applications likebathing. Day; the optimal temperature point can vary according to season, ambient temperature andsolar radiation.

STATISTICAL ANALYSIS

The correlation coefficient (r) and root mean square percent deviation (e) are computed to compare the outcomes of simulations and experiments.

$$r = \frac{n(\sum Xi \ * Yi) - (\sum Xi)(\sum Yi)}{\sqrt{n\sum Xi^2 - (\sum Xi)^2} * \sqrt{n\sum YI^2 - (\sum Yi)^2}}$$

$$ei = \frac{Xi - Yi}{Xi} * 100$$

$$e = \frac{\sum(ei)^2}{n}$$

In the above equations, X and Y represent experimental and simulated data sets, respectively, and n denotes the number of samples in the data. Thus, from the above table the calculation of ei and e is calculated as 1.03 and 3.09% respectively. Also from the predicted water temperature we can calculate the cell temperature and from cell temperature the electrical efficiency is determined.

The equation of energy balance is utilised to calculate the electrical efficiency of the PVT system. The table compares the electrical efficiency of the PVT system to the experimental PV system for a typical summer day using simulation and experiment. The findings indicate that a decrease in operating temperature was associated with an increase in the solar panel's electrical performance. On a summer day, the PVT system's electrical efficiency went up 1.95 percent. For the simulated and actual data, r and e are, respectively, 0.985 and 1.03 percent for the state-space model and 0.980 and 1.38 percent for the energy balance model.

CONCLUSION

In the above work presented we have modelled the PVT panel and also predicted the temperature of solar panel for bright sky days and overcast days utilising various linear and nonlinear system identification techniques, as well as a comparison of Kalman filter estimation with system identification estimation. Solar PV system output changes throughout the day without influencing Kalman filter calculation. However, techniques for identifying systems are incapable of dealing with this level of uncertainty.

Utilizing the same panel configuration, the hybrid PVT system increases the thermal output by utilising the extra heat produced by the PV panels. A new PVT system's design, development, and testing were finished in the work that was presented.

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MATHEMATICAL MODELING OF DUST PARTICLES DEPOSITION ON SOLAR PANEL

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Abstract-Solar photovoltaics (PV) are a major, clean alternative to fossil fuels and a crucial component of the supply of electrical energy. Temperature, wind speed, and correct installation factors like tilt angle all influence the performance of the PV model. Sand, dirt, and rock mixtures, building waste, and automobile transportation pollution are all sources of the dust that accumulates on solar photovoltaic panels. The solar panels' glass collects dust, which reduces their ability to produce Electricity. In this paper, the dust deposited on panel is mostly cleaned by Manuel methods. Mathematical model of dust Deposition on Solar panel

INTRODUCTION

Due to its negligible carbonfootprint and limitless energy significant. However, a variety of environmental challenges that occur before and after the installation of PV modules on the field have a significant impact on their performance and lifespan supply, solar power is becoming more and more. Solar panel soiling is one. One method of cleaning up the environment of airborne pollution is dry deposition of particles. Pollutants are deposition via eddydiffusion, inertia effect, gravity settling, hermophoresis, diffusiophoresis, impaction interception, electrostatic effects, lift forces, and shear fields. One goal is to explore the impacts of eddy diffusion and particle inertia while limiting most other forces driving the deposition of gases and particulates because these processes' eddy diffusion and inertia effects are the least known of these ones across flat surfaces. It may be easier to analyze, generalize, and forecast the more challenging problem of deposition to complex environmental surfaces once deposition from turbulent airflow to smooth surfaces can be anticipated for isothermal circumstances. Dust build-up decreases the glass cover's transmittance, which in turn quickly diminishes power output. The chemical characteristics of glass and EVA sheets can also be impacted by dust, moisture, and temperature, which can also hasten other degradative events. A sandstorm in the desert causes scratches on the module, which has a negative impact on its lifespan and functionality.[4]

MATHEMATICAL MODEL

The three primary processes that contribute to dust accumulating on a PV module's surface are deposition, rebound, and resuspension.Thephenomena of dust deposition on a module is completely explained by a hysics-based model is suggested to describe all of thedust deposition on a module's phenomenon. Because the total deposited dust is subtracted from resuspended and rebounded particles, the amount of accumulateddust is estimated using themodel.The model only considers spherical dust particles and dry deposition Only dry deposition considered while creating the model. Numerous mechanisms, including as eddydiffusion,gravity settling, impaction,thermophoresis, etc., result in the deposition of dust particles. However, gravity settling and diffusion account for the majority of dry deposition. In this work, a wo-layer dust deposition model is onsidered, as seen in fig. 1. In close proximity to the turbulent layer of air, there occurs a laminar wind flow.[4]

DEPOSITED PARTICLE FROM THE TURBULENT LAYER

Mathematically, dust deposition from theturbulent layer and laminarlayer is characterized as particles falling from the turbulent layer by the interaction of eddy diffusion and gravity force. [4][5]

$$F_t = -e\frac{dc}{dh} - cV_g\cos\theta \qquad (1)$$

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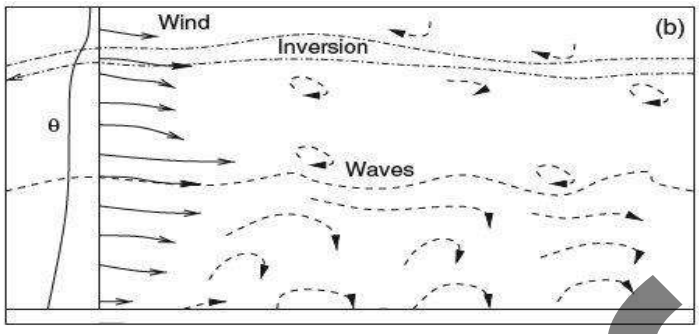

FIGURE 1. Dust deposition on a slanted surface using a two-layer technique

Laminar layer particle settling

$$F_l=-e\frac{dc}{dh}-cV_{impac} \quad (2)$$

Where Brownian Diffusion D is represented as [6], soil particles are moved by chance collisions with nearby air molecules and other aerosol particles, which move based on the temperature of the surrounding medium.

$$D=\frac{Cc*K*T}{3\pi\vartheta dp\mu} \quad (3)$$

Where the air dynamic viscosity=1.849*10^{-5}(Kg/m-s) When airborne particles contact a PV, a process known as impaction which is expressed as PV V_{impac} is written

$$V_{impac}=\frac{A_{IM*U_{wind}*\sigma_{speed}}}{1+e^{-(f(st-1))}} \quad (4)$$

The stokes number is called St, and f is calculated from collected data.

Where the difference between the module azimuth and the azimuth of the wind is the overall dust deposition flow may thus be expressed as follows.

$$T+=\frac{\rho pdp^2u*^2}{18\mu\vartheta} \quad (5)$$

τ + is used to estimate the dimensionless relaxation time

By solving (5) the following method is used to determine how much dust flux was deposited on surface

$$N=\frac{BC\alpha f}{1-\alpha f} \quad (6)$$

In which a_f=exp (-B A_{int}/u_*) (9) These steps are used to determine how much dust is being deposited on the module's surface.

$$Vk=\frac{B}{\left(\frac{1}{\alpha f}\right)-1} \quad (7)$$

$$M=Nt_d \quad (8)$$

The model displays particles with diameters in the range of 0 to 1 as a function of deposition velocity and tilt angle. The model shows particles with diameters between 0.001-0.1m as a function of deposition velocity with varied tilt shown in fig

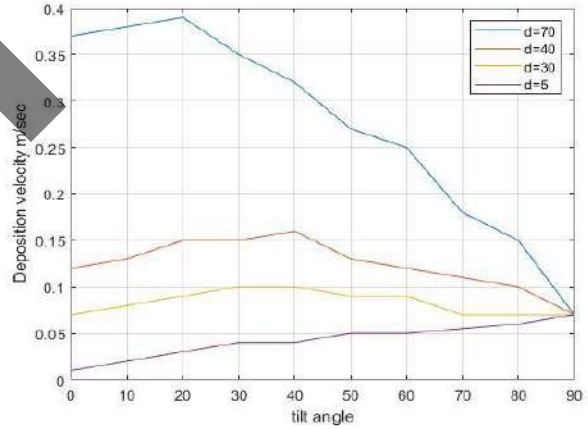

FIGURE 2. Tilt angle in relation to deposition speed with different particle diameters.

With increase in tiltangle Deposition velocity for larger particle decreases and for smaller particles increases. Angle of tilt vs deposition speed with changing particle diameter.[7]

A MODEL FOR DUST REBOUND

Rebounding is the action the process through which airborne contaminants rebound from surfaces deposition. It establishes how many particles are caught by the surface immediately upon impact

$$AB = (\vartheta sin\alpha)t + \frac{1}{2}\frac{g}{\sqrt{2}}t^2 \quad t=\frac{2\vartheta cos\alpha}{g/\sqrt{2}} \qquad (9)$$

Where g is the gravitational acceleration, rebound angle, duration of flight, and is the particle's rebound speed.

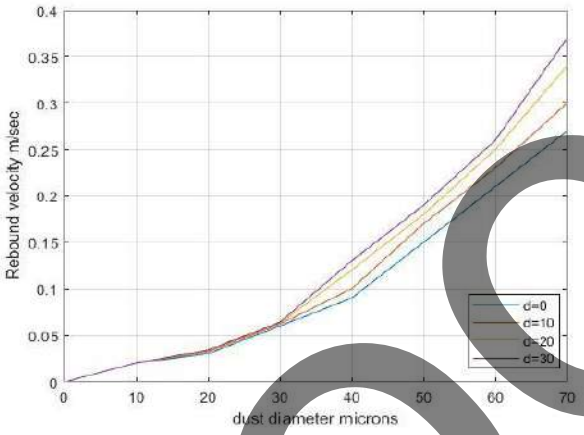

FIGURE 3. shows particle diameter as a function of rebound velocity at various tilt angle.

MODEL FOR RESUSPENSION OF DUST

A renewed suspension of insoluble particles aftert hey have been precipitated. Resuspension Rate can be written as[8]

$$\text{Rate}=w_o \exp[-\frac{Q}{2PE}] \qquad (10)$$

The tangential force pull-off force and height of the potential well Q can both be used to represent the potential energy. The drag force needed to separate a particle from a titled surface when the particle is there is as follows [9]

$$Fdrag = ((Fad + mg)sin\theta + Fext * cos\varphi \qquad (11)$$

Tangential pull-off force is calculated by

$$Fat = \mu f((Fad + mg)cos\theta + Fext * sin\varphi \qquad (12)$$

$Fext$ is the external force of the wind which is written as

$$Fext = \frac{1}{2}Cx * \rho pSpUwind^2 \qquad (13)$$

Resuspension rate can be written as [10]

$$Rrate = f0 \exp\left[-\left(\frac{Fat}{Fdrag}\right)^{xf}\right] \qquad (14)$$

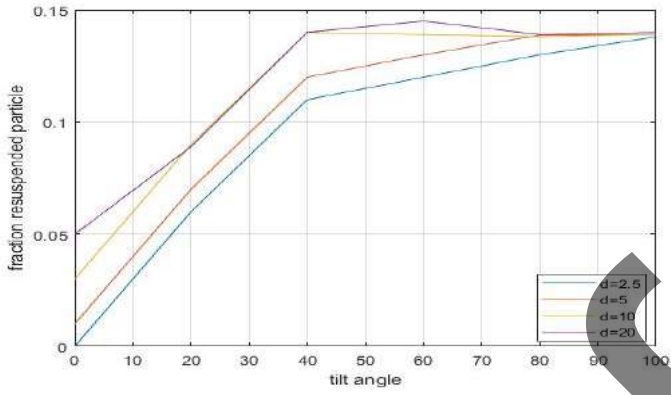

FIGURE 4. shows the relationship between particle diameter and the percentage of particles that are resuspended.

Tiltangle versusfraction of particles resuspended with varying particle diameter.
When tilt angle increases resuspension also increases.

RESULTANT ACCUMULATED MASS OF DUST

After dry deposition, the module's mass may be expressed as the amountof mass collected on the module after dry deposition can be written as

$$M_{effective}=M_d)*f_{remain} \quad (15)$$

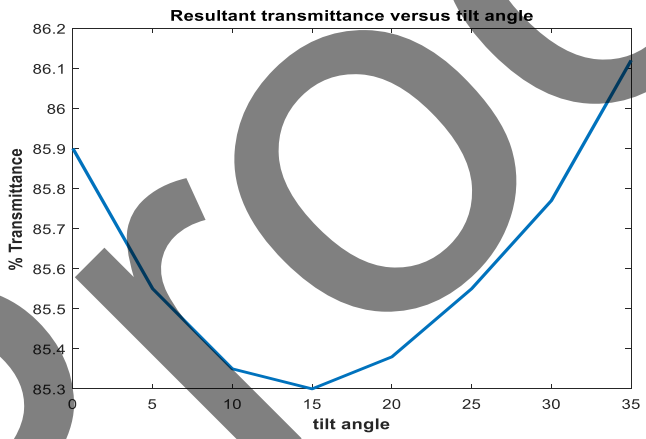

FIGURE 5. Resultant transmittance vs tilt angle.

TRANSMITTANCE OF CALCULATION

The amount of dust build-up on the module's glass cover reduces transmission. Dust mass, angle of incidence (AOI), and tilt angle have all been used to represent this.

$$tr= \exp (- 3*Meffective*\varepsilon 4\rho*A*dpcos\theta*cos\varepsilon) \quad (16)$$

MODEL FOR RELATIVE HUMIDITY

The process of dry deposition is the direct transport of mass to the surface from the atmosphere because of gravitational and diffusional forces. The formula for calculating the growth rate of the dry particle with radius ro owing to water vapor absorption is the potential energy can be represented by the tangential force pull-off force and the height of the potential well Q. When a particle is present, the drag force required to remove it off a titled surface is as follows. [13]

$$r_{p=r_0\times\left[\frac{\rho p CD}{\rho_w d_r}+1\right]^{1/3}} \quad (17)$$

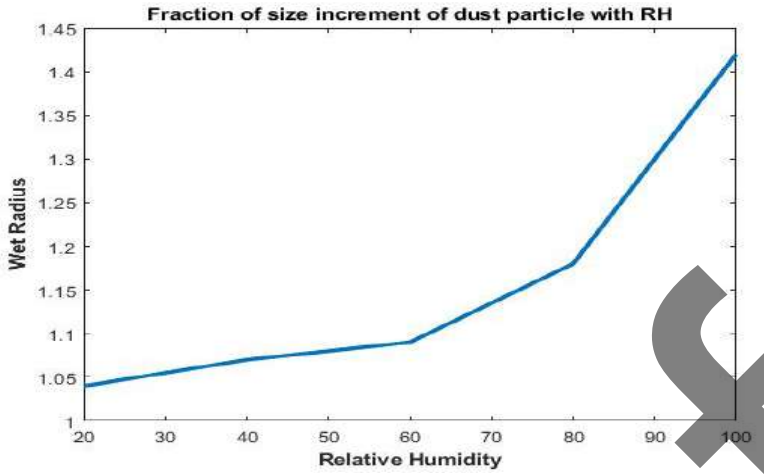

FIGURE 6. Fraction of size increment of dust particle with RH.

where, *C* is a constantand can be determined as

$$C = \frac{\rho p}{\rho_w} f_w \alpha_s r\, o^{\,3} \qquad (18)$$

In Figure 1, the fluctuation in the percentage of dust particle size growth caused by waterabsorption in the presence of relative humidity is shown.

It has been noted that from RH 50% forward, a particle's size rises more rapidly. The quantity of dustdeposition M dep RH on the module cover in the presence of RH may thus be calculated using

the larger value of particle radius, which is determined by tilt angle versus depositionvelocity with the variable particlediameter.

$$M_{dep\_RH} = \left[\frac{V \exp(-V A_{int})/u_*}{1 - V \exp(-V A_{int})/u_*}\right] c_{pM} t_d A. \qquad (19)$$

First part of (3) determine he velocity of dust particle deposition, where

$$B = \left(v_{t \cos\theta + \frac{A_{IM}\, u_{wind}\, \sigma_{direc}}{1 + e^{-(f(s_{t-1}))}}} \right) \qquad (20)$$

EFFECTOF RH INREBOUND

A particle absorbs moisture in a humid atmosphere, and a thin coating of water film is simultaneously generated on a module surface. A liquid meniscus forms right away when a wet particle hits a moist surface.[12]

The particle's kinetic energy, or KE rebound, is increased if it rebounds.

$$KE_{rebound} = \left(KE_{dep} + E_{dep}\right) e^2 - E_{rebound} \qquad (21)$$

$$\frac{V_r}{V_k} = \left(e^2 - \frac{E_{rebound} - e^2 E_{dep}}{KE_{dep}}\right)^{1/2} \qquad (22)$$

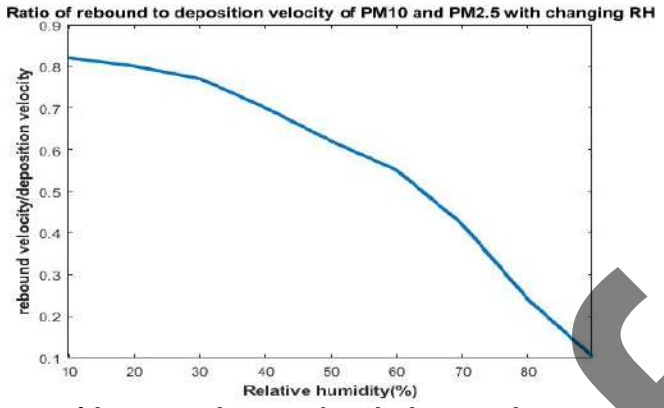

FIGURE7. showing the ratio of deposition velocity to rebound velocity in relation to RH 2.5 and 10 m particles.

Deposition velocity rises as particle size increases with relative humidity. Rebound velocity decreases to increase the capillary force, which reduces the ratio as the relative humidity rises.

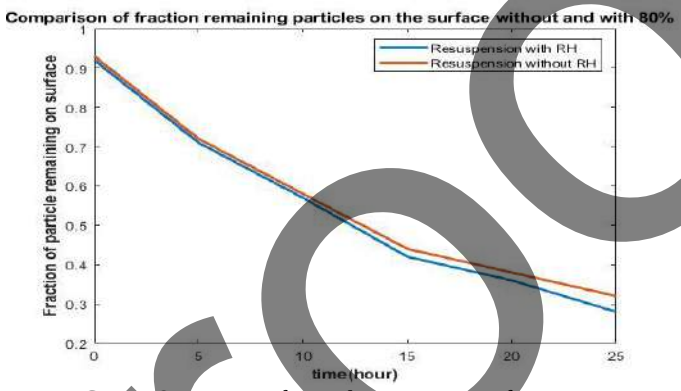

FIGURE 8. Fraction of particle remaining surface vs time.

The percentage of dustparticles that are still present is compared with and without relative humidity. The proportion of particle remaining on the surface increases from 0.55 to 0.65 after 10 hours at 80 percent RH.[14]

Data

For the Pune location, weather information is gathered from the Central Pollution Control Board (CPCB). Regarding latitude 18.516726.

EFFECT OF RHON RESUSPENSION

When the removal force prevails over the adhesion force, the particle detaches and is said to have been resuspended.[13]

$$R_{r\_}\text{RH}=f_o \exp \quad (23)$$

Where,x_f and f_o are constantsand the fraction of particles of particles remaining on the surface after time t_r is

$$f_{re\_}\text{RH}=\exp(-R_{rRH}t_r). \quad (24)$$

Mass on accumulated on module surface is Calculated as

$$M_{acc\_RH=}\left(M_{dep}-M_{rebound}\right)f_{r\_}RH \quad (25)$$

EFFECT OF TEMPERATURE WITH DUST

With a high ambient temperature on the cell, the efficiency of PV cells often falls. That indicates a decline in the amount of electric power the cell produces.[15][16]

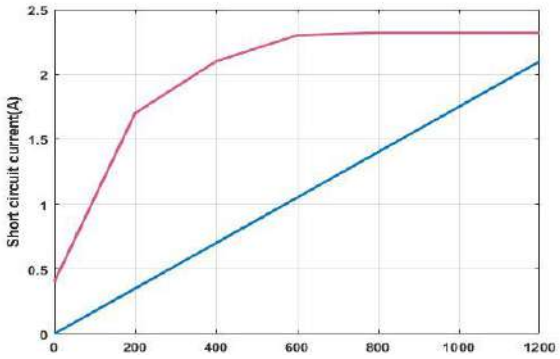

FIGURE9. showing the ratio of deposition velocity to rebound velocity in relation to RH 2.5 and 10 m particles.

Deposition velocity rises as particle size increases with relative humidity. Rebound velocity decreases to increase the capillary force, which reduces the ratio as the relative humidity rises.

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INVESTIGATING THE PERVASIVENESS OF EXISTING FINTECH SECTOR OF INDIA

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Abstract. The phrase "Fintech" (Financial Technology) refers to software and other cutting-edge technology utilized by companies that offer automated and enhanced financial services. It is a term used to describe a new technology designed to enhance and automate the provision of financial services. With 6,636 FinTech businesses, India has the highest rate of FinTech adoption internationally and is one of the fastest-growing Fintech industries. India has made significant progress in the area of digital payments, recording over 5.7 BN transactions each month in September of this year, amounting to about $2 TN (Total Digital Payments). India will surpass the combined total of the US, UK, and China in terms of real-time online transaction volume in 2020 with 25.5 Bn real-time payments transactions. This survey paper elaborates on different aspects of the Fintech sector in India, and various issues faced by many prominent fintech companies like unbanked population, regulation, technology integration, user experience, etc. It also describes technologies that underpin fintech business models, including blockchain technology, machine learning, artificial intelligence (AI), Cloud computing, the Internet of Things, etc.

INTRODUCTION

The technology utilized in the back-end systems of reputable financial institutions was first referred to as "fintech" in the twenty-first century. Since then, there has been a shift toward more consumer-focused services and, consequently, a more consumer-focused definition. Today's fintech encompasses a wide range of industries and sectors, including investment management, retail banking, education, and charitable fundraising, etc. Some of the main structural problems affecting Indian financial services include the need to expand outreach, enhance customer experience, minimize operational friction, and encourage acceptance and utilization of the digital channel. [2]. Due to their legacy-prone processes and higher operating cost models, traditional banks and financial service providers will fall behind these digital FinTech companies as they try to catch up with them. FinTech has the ability to expand the market, influence consumer behavior, and lead to long-lasting changes in the financial system. [1].

While every other industry had a decline in growth during the epidemic, the Fintech sector experienced a boom as COVID-based laws limited physical travel and promoted contactless transactions. According to research by Boston Consulting Group (BCG) and the Federation of Indian Chambers of Commerce and Business, India's Fintech sector may reach a market value of $150–160 billion by 2025. The Indian market closed 33 Fintech investment deals for US$647.5 million in the quarter ended June 2020. In India, there are over 2100 Fintech companies, with more than 67 percent having been founded in the last five years. Investments of more than US$8 billion were obtained throughout all stages of investment in India's Fintech business in 2021, indicating exponential increase in funding.

Fintech, while its enormous potential, has a difficult road ahead of it. Fintech makes a significant contribution to the industry, but it also brings with it a great deal of uncertainty and danger. While fintech marks the dawn of a new era in finance, it is far from ubiquitous, and it is far from a solution for all ills. It must be implemented carefully because it is both an enhancing and a disruptive force [6].

The core objectives of financial regulation are efficiency, fairness, and stability. With these objectives in mind, financial regulators in the FinTech era are facing the challenge of balancing the benefits and risks previously discussed. They seek to promote market innovation, while at the same time preserving financial stability, market integrity, and fair competition. That mission, however, is considerably exacerbated in the FinTech era for a few reasons.

Technological progress and innovation, which will also support new, disruptive business models in the financial services sector, are the cornerstones of fintech development. Most businesses and fintech pioneers have focused their discussions on five major technologies: blockchain, artificial intelligence (AI), security, internet of things (IoT), and cloud. The acronym can be rearranged as "B.A.S.I.C." where B represents blockchain, A for artificial intelligence, S stands for security, I represent internet of things, and C for cloud.

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This technical review paper is organized as follows: In **Section 2**, What is fintech, advantages of fintech and types of fintech is discussed, **Section 3** describes current fintech scenario in Indian market and different approaches and innovations used in Indian Fintech, whereas in **Section 4** different operational and technical challenges of fintech sector are discussed, in **Section 5** we mentioned different technologies that can be used to improve efficiency and effectiveness of fintech sector of India and finally, we mentioned overall conclusion and the findings about the pervasiveness of existing FinTech sector of India.

WHAT IS FINTECH

Fintech refers to a range of financial technology designed to automate processes in the financial sector, from routine, manual chores to nonroutine, cognitive decision making. [5]. Payment systems, contract verification, risk management, trading, quantitative asset management, mobile banking, lending, customer loyalty, and investment banking are a few of the financial sectors that are susceptible to disruption. Fintech may be characterized by technical advancements in the following three main areas of finance: (a) raising of capital, (b) capital allocation, and (c) transfer of the capital. Fintech is any technology that lowers or does away with the expenses associated with financial intermediation [3].

It is possible to have a firm understanding of the fintech concept despite its complexity. FinTech facilitates financial transactions for people and businesses, increasing their accessibility and frequently lowering their cost. It can also be used by companies and services that use AI, big data, and encrypted blockchain technology to provide exceptionally secure internal network transactions. The main objective of fintech is to remove mechanism that might not be required for all participant parties in a transaction. For instance, we can send money to others at any particular time of the day and have it instantly put into their preferred bank account by utilizing a smartphone app like Venmo or CashApp. The recipient must visit the financial organization to deposit the funds if we want to pay with the cash or a check. [12].

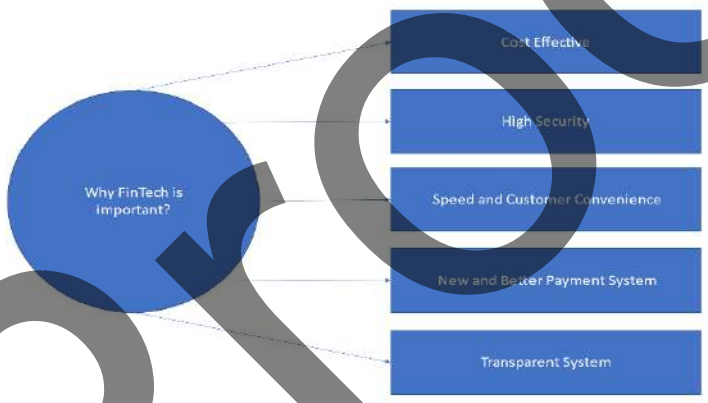

FIGURE 1. Importance of FinTech

Following are some of the common types of Fintech [6]:

MOBILE WALLETS

They belong to the most prevalent categories of fintech. Using services like PayPal, Venmo, Square, Apple Pay, and Google Pay, individuals and companies may send money to one another or accept payments from customers.

CROWDFUNDING

Crowdfunding platforms have revolutionized traditional fundraising strategies by allowing customers to invest their money in businesses, products, and people.

CRYPTOCURRENCY

One of the most well-known and in-deathly researched categories in fintech is cryptocurrencies and blockchain technology. Users can purchase or sell bitcoins on exchanges like Coinbase and Gemini.

TRADING OF STOCKS

Because investors may trade stocks using their mobile phones from any location instead of going to a stockbroker, stock trading applications like Robinhood and Acorns have grown in popularity and innovation.

INSURTECH

A wide variety of insurance products, including home and vehicle insurance, have been challenged by InsurTechs startups. Two examples of InsurTechs companies that have forayed into the healthcare and personal finance industries are Oscar Health and Credit Karma. [4].

FINTECH IN INDIA

India is evolving into a vibrant ecosystem that offers finance start-ups a platform to possibly become unicorns worth billions of dollars. Fintech start-ups in India are aiming for various goals, from tapping into new markets to investigating overseas ones. Even though the Payments and Alternative Finance segments dominated the sector's investment flows in 2015 with over 90% of the total, there has been a substantial shift towards a more equitable distribution of investment across sectors, including InsurTechs, WealthTechs, etc. [8]

India's demographic dividend, rising national disposable incomes, a sizable unbanked population, increased internet access and smartphone penetration, and a quickly developing e-commerce market are just a few of the macroeconomic variables that are fueling the growth of the fintech industry in India. There are 23 fintech companies in India with "Unicorn Status". Fintech accounts for 1/5 of startup unicorns. India saw the highest volume of real-time transactions overall in 2021, surpassing 48 billion, or 6.5 times the volume of the world's five largest economies (the U.S., Canada, the U.K., France, and Germany). This led to cost savings of USD 12.6 billion for Indian businesses and consumers in 2021. By 2025, the digital investing industry is expected to be valued $14.3 billion, up from $6.4 billion in 2021, at a 22.4 percent 5-year CAGR. The market for digital payments in India is predicted to more than treble from $3 trillion now to $10 trillion by 2026. Digital payments (non-cash) will account for roughly 65 percent of all payments by 2026 because of this extraordinary development [8].

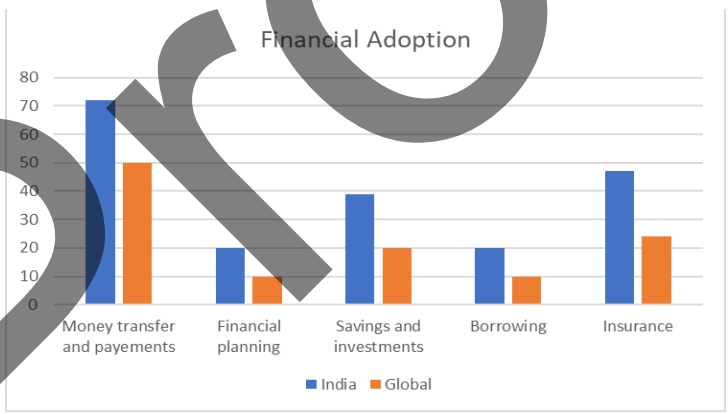

FIGURE 2. FinTech adoption among digitally active consumers in percentage

Through funding and promotional measures, the Indian government and authorities like SEBI and the RBI are actively promoting the Indian economy's desire to develop into a strong fintech ecosystem and go cashless. To facilitate penetration of the digitally enabled financial systems to the institutional and general people, the following multi-pronged approach has been used [1]:

FUNDING SUPPORT

A USD 1.5 billion fund for businesses was included in the Start-Up India plan that the Indian government announced in January 2016.

FINANCIAL POLICIES AND ENABLEMENT

The Jan Dhan Yojana has helped more than 200 million previously unbanked people open accounts. The use of Aadhar has been increased for the Jan Dhan Yojana, provident fund, and pensions.

TAXATION

Tax credits for businesses who do more than 50% of their transactions online. Start-ups might receive discounts of 80% on their patent expenditures. A three-year income tax exemption for new businesses. Capital gains tax exemption for longer than 24-month investments in unlisted enterprises (from 36 months needed earlier). The Ministry of Finance has recommended eliminating the surcharge for using a credit card or the internet to pay for government services.

IP FACILITATION SUPPORT

The government will help startups with the costs of facilitators for their patent, trademark, and other design work.

INFRASTRUCTURE

To encourage the development of the nation's digital infrastructure and draw in foreign investment, the Digital India and Smart Cities projects have been introduced. There isn't a generally recognized taxonomy for FinTech advances, according to a WEF 2015 paper. Through its scoping exercise, the WG divided some of the most notable FinTech inventions into five major groupings to acquire a sense of the broad scope of the continuing breakthroughs in this field. While not a thorough examination of all FinTech developments, this article focuses on those thought to have the biggest potential impact on financial markets. Some of the most well-known FinTech inventions can be simply divided into the following divisions based on the financial market activities where they are most likely to be used [8]:

TABLE 1. FINTECH INNOVATIONS

Innovation	Technologies Used
Payments and Settlement	Mobile payments Digital currencies
Deposits and Lending	Crowdfunding Distributed ledger technology Digital crypto currencies
Market provisioning	Cloud computing Smart contracts
Investments	Robot advisor Smart contracts
Data Analytics & Risk Management	Artificial Intelligence Big data analytics

Further growth in India's active internet user population is anticipated, mostly due to the country's high rate of rural adoption. Furthermore, it is predicted that India will add 21 million high-income households and 140 million middle-income households by the year 2030, fueling demand for the expansion of the Indian Fintech sector.

CHALLENGES FOR FINTECH ADOPTION IN INDIA

Numerous well-known Fintech companies struggle with a variety of problems, including protracted funding cycles, unmet goals, and rising losses [7]. The fintech sector, however, constantly faces several additional significant difficulties:

CENTRALIZED SYSTEM DEPENDENCY

Despite the seeming convenience that fintech solutions provided, actual control has always been held by outside parties. Users are still waiting for a confirmation in their favor while the transactions continue to be held with only the approval of higher authorities [12].

REGULATORY LAWS

Numerous rules unavoidably hold down the growth of Fintech start-ups in the Indian financial sector. These limitations are not only challenging to adhere to, but they also used to make it challenging for Fintech organizations to enter the Indian markets. To prevent fraud, making sure to complete the regulations are created as a strict regulatory structure. However, they too serve as significant impediments to entry for new Fintech players. Before they even begin operations, FinTech companies are required to perform large number of requirements.[11].

TENDING TOWARDS CASH

Most Indians adopt a conservative posture and opt to use cash for daily transactions. They have relied on money as a sales medium for a very long time, therefore changing their routines and implementing new tactics is difficult for them. It is challenging to offer financial services in an unbanked market because these services are frequently connected to online fraud. The value that FinTechs offer through their cutting-edge products and services is not understood by many Indians because of their lack of financial literacy.

UNBANKED POPULATION

Due to weak infrastructures, such as low internet penetration and low literacy rates in India, the emergence of FinTechs was sluggish. Although the Indian government is addressing these problems with generous policies, the advantages won't become apparent for some time. The poor level of financial literacy in the Indian society is another barrier to the establishment of fintech in India [9].

CYBER-SECURITY THREATS

Financial technology businesses handle private consumer information. Online transactions suffer significant financial losses because of numerous cybersecurity concerns. These are completely unwarranted for customers. The same technology that makes life more convenient also makes it easier for scammers to take money from people's online accounts. This is a consistent source of the growth of FinTechs. FinTechs must be protected from any threats put out by hackers. Digitally accessible financial information about people and businesses in enormous quantities. This raises the possibility of cybersecurity breaches [10].

GOVERNMENT SUPPORT

Fintechs face a serious lack of government incentives and support to protect their interests in the Indian financial markets. This can be quite demoralising for emerging Fintech players. Fintechs are crucial for fostering economic growth, so it is imperative to give them with all the resources they need to be successful. [9].

INDUSTRY RELATED PROBLEMS

Fintechs are made to function using a complex working model. They find it challenging to keep good ties with other financial institutions like banks as a result. Conversely, banks are hesitant to collaborate with fintechs out of concern for their reputation [10].

TECHNOLOGIES USED IN FINTECH

By utilising innovative and cutting-edge technologies like blockchain, AI, ML, and cloud infrastructure, the entire financial services business is undergoing a significant transformation. Strong talent pools, more bank-Fintech collaboration, and the rapid pace of technical advancements on a daily basis are three significant technology elements that are fueling the expansion of the Fintech industry.

REGTECH

Recent ground-breaking developments in fintech software are having a positive impact on regulatory technology, resulting in automated systems to manage regulation monitoring, compliance, and reporting. A practical technique to assist a financial institution in complying with legal requirements is to keep track of new limits in a single database. RegTech, also referred to as regulatory technology, assists companies in monitoring, reporting, and adhering to regulatory requirements. These startups may use big data, cloud computing, AI, and predictive analytics to automate compliance tasks, reduce fraud risk, enhance authentication, and simplify identity management. Banks can decrease the cost of compliance while increasing transparency and uniformity with the aid of regulatory technology.

ARTIFICIAL INTELLIGENCE

Artificial intelligence helps banks analyze their massive data to improve the caliber of their decisions and solutions. Utilizing cognitive abilities to sift through a mountain of unstructured content and data to get more insights is the newest

AI trend. In the future, AI chatbots and virtual assistants will be able to carry out repetitive tasks including small transactions, client financial counselling, and more. Applications of AI will permeate all facets of front, middle, and back-office processes in the financial sector. Market trackers, automatic transactions, robot advisors, tailored products, personalized user experiences, personalized analytics services, intelligent service robots and chat interfaces, alternative credit ratings based on non-financial data, and facial recognition authentication are a few examples of customer-facing applications. Applications for the middle and back offices include intelligent procedures, improved knowledge representation tools, and fraud detection using natural language processing.

BLOCKCHAIN

While it no longer garners as many headlines as possible, blockchain has been on the rise since 2018 and the innovation isn't going anywhere. Blockchain technology has already been formally embraced by many Asian banks to secure financial transactions, and European and American institutions are expected to follow [14].

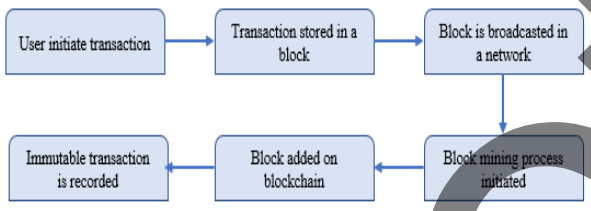

FIGURE 3. Blockchain transaction flow

Use of blockchain can provide various benefits to the system such as, each transaction is encrypted, making it impossible for anyone to intercept it, the transaction required the approval from all network stakeholders or miners, which makes a hacking assault extremely unlikely, and Tokenization enables multinational corporations to use global currencies as opposed to national currencies. The bulk of people become familiar with the blockchain primarily because of cryptocurrencies. Blockchain offers a safe, transparent, stable, and reliable ledger to record agreements, transactions, and records in addition to using cryptocurrencies for speedy and private online transactions. Intra-bank and inter-bank transactions can now be completed more quickly and for less money thanks to the use of technologies like blockchain bonds, clearing, and settlement frameworks [13].

INTERNET OF THINGS

On the other hand, the Internet of Things (IoT) streamlines financial operations both internally (team organization) and externally (client management and communication). Mobile devices can communicate directly with one another via an IoT network to link up with financial systems and send data. In the banking industry, IoT-based inventory and property finance, which combines IoT with blockchain, enhances risk management by ensuring that accounting records match actual transactions and enables a new system of trust. IoT is revolutionizing traditional trade finance in shipping and logistics by enabling banks to create new products based on tracking the flow of goods, such on-demand liquidity, and other advancements offered via smart contracts. By including financial services in wearables like digital payments, the Internet of Things is also bringing banks and their customers closer together. [15].

MACHINE LEARNING

One of the main AI components, machine learning (ML), is mainly utilized in banking in the following areas:

- ML tools analyze current fraudulent incidents, identify common trends, and assess whether a specific company doesn't exhibit comparable behavior. Because of this, we can identify dubious financial institutions and anticipate potential frauds.
- Risk management software analyses the company's operation and searches for possibly hazardous tendencies.
- An ML-powered program that scans investment records can identify the most likely future developments.
- By analyzing consumer data, the ML platform creates an intelligent client profile.

CLOUD COMPUTING

Cloud computing has a clear impact on fintech. Although cloud computing in fintech services is still in its infancy, there is a tremendous room for expansion. Cloud computing in fintech is expanding steadily, even though cloud adoption is still in its early phases. Additionally, 22 percent of all financial applications are currently operating in the

cloud. Increasing flexibility, better security, sparked creativity, and increased scalability are some of the key advantages of cloud computing adoption in the finance sector. These advantages are currently influencing important trends that are fueling expansion in the fintech industry.

Cloud computing enables logical access control, which enables the authenticated user to access data whenever and wherever they are needed. This allows Fintech companies to handle their data more securely. Businesses use the cloud's capabilities to securely store and manage data, particularly for lending and payment apps.

CONCLUSION

The findings of this study demonstrate how the Fintech industry is changing India's financial services, and the world's fastest growing fintech market is in India. The traditional cash-based Indian economy has reacted well to the potential of fintech, which was primarily fueled by a spike in e-commerce and smartphone adoption. The fintech industry is a focus for the Indian government, which also supports it and promotes new concepts and inventions. It is evident from the rapid development of fintech technologies that India has tremendous entrepreneurial potential. Fintech undergoes a new transformation each year due to the development of technologies and the constantly shifting needs of the financial markets.

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A Novel Approach of Spectrum Utilization during Spectrum Handoff in Cognitive Radio Network

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Abstract. The exponential growth of wireless connectivity and smart devices nowadays, spectral bands are becoming much more crowded and occupied, while on the other hand spectrum allocated to licensed users is remains underutilized. Research in cognitive radio technology becomes more significant for proper utilization of spectrum. Although most of the licensed bandwidth is already reserved for authorized users, unlicensed users have a difficult time sharing the frequency bandwidth without impacting with the transmission of licensed users. Utilizing the momentarily vacant spectrum that has been allotted to authorized users, often known as the "spectrum hole" or "white space," is made possible through cognitive radio. If a licensed user reappears on its assigned channel to further utilize it, the unlicensed user quickly leaves the frequency and resumes communication in another open area of the spectrum. The movement of SUs is known as Spectrum Mobility and this gives rise to a new kind of handoff called Spectrum handoff. In this paper we have proposed an algorithm for finding the most appropriate channel for SU, minimizing the delay in the process of spectrum handoff, and maximizing the spectrum utilization byaccommodating more SUs with PU. Concept of backup time for SUs is introduced and each proposed algorithm is implemented forvariable and fixed backup time. Utilizing MATLAB, we conducted simulations. and results analysis represents the proposed algorithmsgives better utilization of spectrum. Further we have observed with variable backup time we can accommodate 3 time more SUs if number of available channels is increased. Also, if number of PUs reappearing is increased, with variable backup time we can accommodate more SUs in comparison to fixed backup time.

INTRODUCTION

Cognitive radio networks (CRN) [1] intelligently identified the communication channels which are in use and whichare not. Gaining the best frequency using cognitive ability and adaptability is the main goal of spectrum sensing, cognitive radio. This includes sensing, management, mobility, sharing of spectrum. Additionally, by effectively utilising the transmission spectrum, cognitive radio networks (CRN) aim to raise the caliber of wireless applications. In CRN the spectrum is accessed dynamically to provide ubiquitous connectivity and excellent bandwidth efficiency forthe wireless end-users. In CRN, the end users can be categorized into two categories, unlicensed devices (also referredto as Secondary Users/SUs) and licensed devices (also known as primary user/PUs). The primary problem for SUs is to utilize the spectrum without interfering with the transmission of other licensed users because the majority of the frequency has already been assigned to PUs. The cognitive radio makes it possible to utilise the white space, also known as the spectrum hole, which is momentarily unoccupied spectrum. The unlicensed user SU makes it possible to utilize the spectrumin a dynamic manner by obtaining the best available spectrum using cognitive capability and reconfigurability. If a licensed user reappears on this channel to further utilize it, In order to prevent interruption, the CR changes its transmission power level or modulation technique and either travels to some other unused spectrum or remains in the very same band. The movementof secondary users from one band to another is known as spectrum mobility and this gives rise to a new kind of handoffknown as spectrum handoff. In order to adapt to the dynamic spectrum environment, the CRN is required to do somespectrum-aware operations. These operations include spectrum sensing, spectrum decision, spectrum mobility, and spectrum sharing. [2,3].

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In spectrum sensing a SU is allowed to identify spectrum holes using different sensing techniques. There are number of sensing technique in CRN, in [1.2] author discussed various sensing techniques with their advantages and challenges.After sensing a list of available channels are identified. In spectrum decision from the list of unused available channelsidentified in sensing, a SU selects the most suitable band for its transmission. The spectrum mobility occurs when thePU reappears on the licensed channel, the SU has to vacate the spectrum and resume the incomplete transmission ona different spectrum hole. To complete the transmission spectrum handoff is triggered. In spectrum sharing multipleSUs share a single spectrum hole by maintaining coordination among them. In this paper, we have discussed the spectrum mobility and spectrum handoff process in detail and proposed an algorithm for better utilization of spectrum

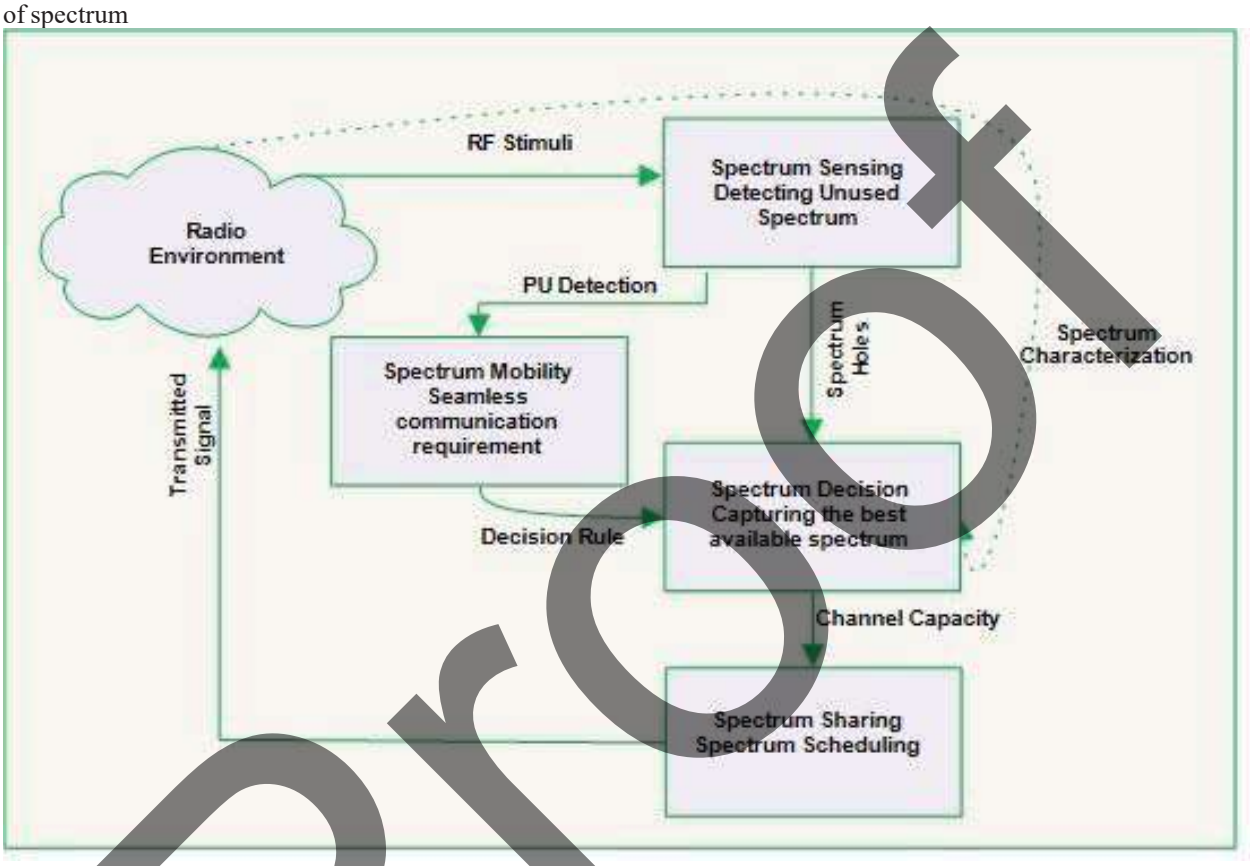

FIGURE 1. Cognitive Cycle

holes identified in spectrum decision operation. This work utilizes the concept of providing backup channel to the secondary user, and each backup channel has a backup time. The proposed algorithms are implemented with fixed and variable backup time. This concept of providing backup time to backup channels for SUs constitutes the novelty of the work. Till now very little literature on backup time is found and in that only fixed backup time is considered in the research area of spectrum handoff [10]. We have introduced the concept of varying backup time. We implemented the proposed algorithms and found that proposed algorithm with variable backup time give better results than fixed backup time. This paper is divided into five sections, Sect. 1 gives an introduction to CRN and discusses the novelty of the proposed work, in Sect 2 is spectrum handoff and its various approaches are discussed in detail, in Sect 3 outline of the proposed algorithm is given, Sect. 4 includes the simulation results, and in Sect. 5 we conclude our work with the future aspect.

SPECTRUM MOBILITY

Spectrum mobility is an important phenomenon in CRN. On the arrival of licensed user the secondary user give up the occupied channel by halting its transmission and move to other available channel or has to stop its transmission till the PU using the licensed channel. The process of spectrum mobility and handoff is shown in below figure Fig. 2. When PU reappears, SU will resume the unfinished transmission through spectrum mobility. Spectrum mobility is unavoidable event in a cognitive setting, and it must be addressed carefully with minimum degradation in quality of transmission. Spectrum mobility introduces a new kind of spectrum handoff that is differentfrom the classical handoff because in a traditional handoff, every user has the same preferences, and the choice to switch channels is typically made as a result of a drop in quality of the current channel signal. [4, 5]. In CRN Spectrum hand-off occurs in three situations:

- When PU is detected

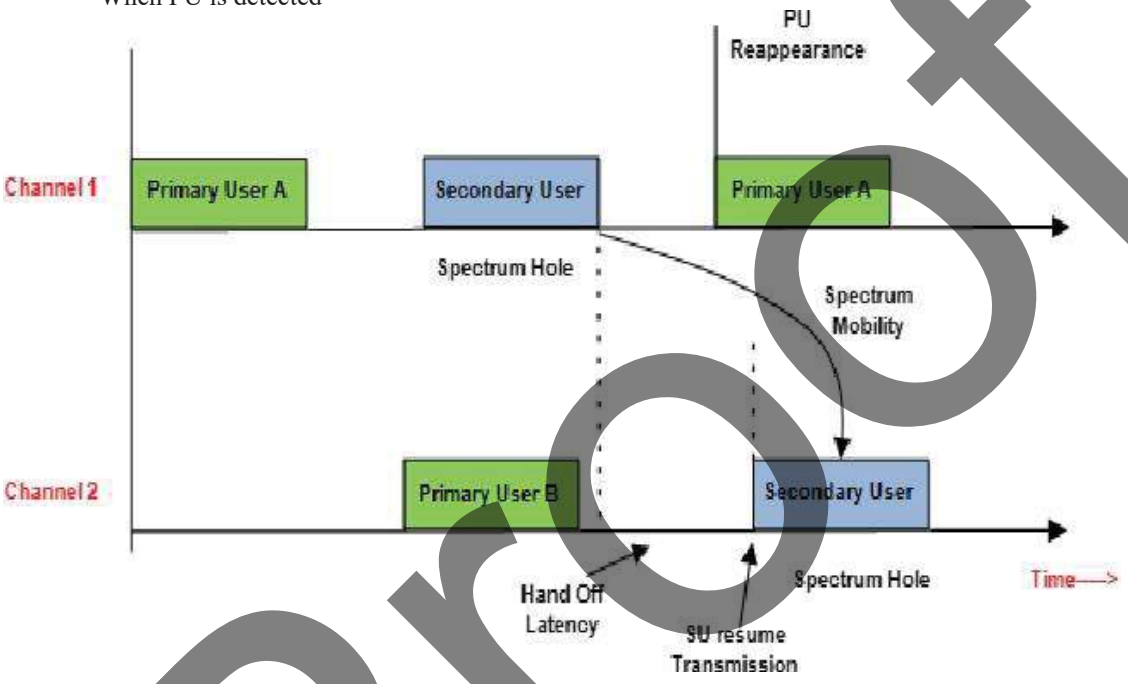

FIGURE 2. Cognitive Cycle

- Secondary user loses its connectivity due to movement of users involved in ongoing transmission.
- If the current spectrum band not providing the acceptable quality of service.
- If a handoff of the spectrum happens, the SU would next attempt to reclaim the medium by performing one of the following three procedures:
  - SU will remain on the existing frequency and delay transmission until PU has finished.
  - Choose a frequency from a list of channels that have already been felt; this is known as a preset spectrum handoff.
  - Sensing-based spectrum handoff is another name for swapping to a certain channel right away after sensing the spectrum.

SPECTRUM HANDOFF STRATEGIES

In the process of spectrum mobility, spectrum handoff latency is the time delay in resuming the unfinished transmission by the unlicensed user. When spectrum handoff occurs in CRN, the main challenge is to reduce the handoff latency,by searching for a suitable spectrum hole in minimum time. There are four types of spectrum handoff that may occurin CRN which are categorized on the basis of their process and handoff latency. The spectrum handoff

strategies [6, 7, 8] are mentioned as below.

STATIC SPECTRUM HANDOFF

The CR node is expected to remain on the same channel during a static spectrum handoff and refrain from transmitting until the channel is once again open. As a result, it experiences a large delay brought on by the transmission of PUs and is regarded as the least effective of the four types..

REACTIVE SPECTRUM HANDOFF

In this situation, SUs leave the authorised channels when the PU shows up. When adopting the reactive handoff approach, handoff delay plays a significant role in deciding how effective the system is.

PROACTIVE SPECTRUM HANDOFF

Here, SUs are notified when they must leave the licensed channel using predictive and learning approaches. This method significantly lowers the amount of upcoming handoffs and experienced comparably decreased handoff latency. However, in cases of subpar learning and prediction, the total system performance may suffer. In order to represent the system with the proactive handoff, a complicated algorithm is needed.

HYBRID SPECTRUM HANDOFF

It involves trade - offs between the high complexity and high latency (reactive spectrum handovers) (proactive spectrum handovers). It uses reactive decision-making after implementing proactive spectrum sensing.

LITERATURE SURVEY

In [15] a handoff scheme is developed using multiple attributes decision making methods such as simple additive weight (SAW), grey relational analysis (GRA), and cost function-based method (CFB). MATLAB is used for implementthe proposed work which is used efficiently implemented to select the best network in line. Spectrum sensing and sharing is a challenge for CRN, in this study and optimization technique is used to handle these issues. In [16] a genetic based hybrid spectrum handoff technique for IoT is proposed. The proposed algorithm considers the regularity of PU activities in space and time and identifies the most probable of channels for spectrum handoff. In [17] importance of spectrum mobility is discussed, a comparison of various approaches of handoff is presented. A new proactive handoff technique is designed to reduce the latency and information loss during spectrum handoff. The results show that that proposed protocol is better than reactive spectrum handoff. Till now very little literature on backup time is found and in that only fixed backup time is considered in the research area of spectrum handoff [9]. In [11] the authors suggested a new method for SH that takes into account the need for a time limit in order to reduce needless handoff. First, depending on the queue connected to the channel, the anticipated delay of application packets is determined. The rate of SH infractions was estimated using the anticipated delays, and the choice was made to avoid needless handoff. The SU must stay on the same channel unless the estimation of the cumulative probability exceeds a specified threshold in order to prevent unwanted handoffs. In [12], the authors suggested an expedient and proactive decision-making system for SH in an effort to shorten the service's overall duration and SH latency. Using a queue as a model, the proposed mechanism was examined. The effectiveness of the suggested SH mechanism was assessed and contrasted with the existing SH mechanisms. Results indicate that for various traffic arrival rates and various service rates, the revised mechanism was faster than the previous methods in terms of average handover time and overall service time. However, this work does not take into consideration any preference allowing SUs to pick up where they left off on a specific target channel. The authors of [13, 14] developed a proactive SH method based on statistical analysis of observed channel usage. In this SH architecture, problems with rendezvous and network coordination have been resolved without the use of a common control channel. The distributed channel determination approach prevented

the collision between the SUs. However, the authors did not offer a reliable protocol to prevent this clash.

PROPOSED METHODOLOGY

On the reappearance of the primary user in the process of spectrum mobility, the secondary user shifts to another available channel. This complete process includes sensing of the spectrum to find a spectrum opportunity, spectrum decision to identify whether the selected channel is appropriate for SU or not, and at last if the suitable channel is determined, how it can be shared among SUs. These cognitive functions make the spectrum handoff a time-consuming process. The total time taken by this process is termed as handoff delay or latency. We can have two types of spectrum handoff strategies, predetermined spectrum handoff, and sensing-based spectrum handoff. In the former a channel is selected from a list of previously sensed channels, hence requiring less time in spectrum handoff. In the sensing-based handoff, the delay is more as it includes sensing time and switching time whereas, in a predetermined handoff, sensing time can be avoided, and only switching time is the main contributor to the total handoff delay. The large handoff delay can degrade the performance of CRN considerably. In this article, we have considered a predetermined spectrum handoff technique; we also assume a database that has the channel status for each hour. This database can be created on the basis of past usage of channels and by applying accurate sensing techniques to sense the channel. We also assume an infrastructure-based architecture for transmission between two SUs, in which an access point is required for the transmission. All three devices (two SUs, one Access Point) have to use the same channel for transmission in order to maintain connectivity. The major devices' temporal channel utilisation is treated as a random process. Since primary devices don't always use the channels they're supposed to, some channels may occasionally go idle for a while, giving secondary devices the opportunity to take advantage of them. These unoccupied periods change depending on how the primary device is used. In this work, N channels are taken into account, and it is assumed that each spectrum channel has a separate primary user assigned to it. It is assumed that each channel's principal device utilisation follows a random ON/OFF process [9]. When there is an ON-period, primary devices are using the channel and secondary devices cannot use it. A channel is said to have a spectral opportunity when there is an OFF-period, which shows that secondary devices can utilise the channel. The values of the ON- and OFF-periods on each channel are determined by the usage patterns of the principal device and are presumed to be independent. Probability that a channel is being used by a primary user at time t can be calculated as $Pou(t) = Ton/(Toff + Ton)$.

Probability that a channel is at rest i.e., not used by PU at time t is $Poff(t) = Toff/(Toff + Ton)$. The $Poff(t)$ is also the probability that a SU can utilize the licensed channel hence channel utilization by a secondary user can be expressed as below:

$$Channel\ Utilization = Toff/(Toff + Ton)$$

Above mentioned channel utilization is fixed at a certain time. When the number of SUs increases each secondary user wants to access the spectrum and the available channels with fixed utilization have to be divided among the SUs. To accommodate more SUs there should be a restriction on SU's time duration for which they can utilize the channel opportunistically.

The intention is to lessen the handoff hindrance and to improve the spectrum utilization by accommodating more SUs. In this paper, we provide a facility of backup channels to SUs. Backup channels are the additional channels given to SUs along with the primary channel referred to as the candidate channels for transmission. When a PU reap-pears on the licensed channel, SU switches to the backup channel immediately without sensing the spectrum which reduces the handoff delay significantly. Therefore, SU requires two channels for transmission one is the candidate channel where actual transmission occurs and the other is a backup channel. We have proposed algorithms to find the available channels, candidate channels, and backup channels list. A list of previously sensed available channels is provided from which a candidate and backup channel are selected for SU transmission. The proposed algorithm to find the available channels for a secondary user is given below. As explained above the channels are modeled in ON/OFF time intervals. A database on the basis of past usage of the channel by a primary user is considered to predictthe channel status as ON and OFF. The algorithm 1 is used to find a list of available channels for secondary user andlater find the candidate and backup channel.

Input: *n* total number of channels, *tmin* minimum time required by SU to transmit, *t_Time*: time when SU start its transmission,*i* :loop counter initialize to zero, Database provided by 3rd party(channels status *Toff* per hour)

Output: *available_list []*: list of available channels.

While(*i* <= *n*)
Create a list of *Toff*, at time=*t_Time*
If*Toff*>*tmin*
available_list []← *available_list* + *i*;i++;
end
If
end
whil
e
return *available_list*;

ALGORITHM 1. Backup Time Calculation (m, number_SUs, backup_Toff)

In the above algorithm, a list is obtained for a set of SUs, which have the same transmission range and same initial requirement of minimum transmission time *tmin*. A list of channels is obtained from the database in which each channel will have *Toff* more than the minimum time required by SUs to transmit. The next task is to find the candidate channel and backup channel for the secondary user. Algorithm 2 explains the method in detail, in our proposed solution as we assume no SU can transmit without a backup channel. In algorithm 2, the list of available channels obtained in algorithm 1 is served as the input. An array list is created of the *Toff* values of the channels listed in the available list. The channel number that has the highest value of *Toff* is found and assigned as a candidate channel fora SU, the list of available channels are updated and again the channel having the maximum value of *Toff* is found andassigned as the backup channel of the SU again the list of the available channel is updated. In the end, the algorithmreturns the candidate channel and backup channel and a list of available channels. By providing a backup channelto SU, it can switch to a selected backup channel if PU reappears or whenever required. It avoids the unnecessary sensing-based handoffs which can occur due to the vague conduct of PUs, therefore, reducing the handoff delay.

Input: *n available_list []*, List of the available channels from Algo 1., *avail_Len*, number of channel in theavailable list.

Output: *candidate_Channel*, candidate channel for SU,
backup_Channel, backup channel for SU,
available_New,updated available list of channels after allocation.
while(*i* <= *avail_Len*)
candidate_Channel=find max. *Toff* and corresponding channel number. *available_New* = *available_List* –(*candidate_Channel*);
backup_Channel=find max *Toff* from *available_New* and corresponding channel number.
available_New = *available_List* – (*backup_Channel*);
endwhile
return *candidate_Channel, backup_Channel, available_ New*

ALGORITHM 2. Candidate and Backup Channel (available_list, avail_Len)

IMPROVE SPECTRUM UTILIZATION

The above-mentioned algorithms are used to achieve the objective of reducing handoff delay also we can improve the spectrum utilization by providing a backup time to backup channels so that each SU can exploit the available channels and proceed to transmit. The Backup time may be defined as the time period for which a channel is served

as a backup channel to a SU, it can be fixed or can be varying with predefined parameters. When backup time expires a new backup channel is determined for SU. Till now very little literature on backup time is found and in that only fixed backup time is considered in the research area of spectrum handoff [10]. In this work backup channel with varying backup time is proposed and results show that varying backup time will increase the spectrum utilization. To accommodate more numbers of SUs in the network backup time of a backup channel should be reduced. By reducing the backup time as the channel will be freed and can be served as the candidate or backup channel to other SUs. The transmission rate is inversely dependent on the number of SUs that can be accommodated, as more SUs can introduce noise for other SUs. Hence, there should be a tradeoff between the number of SUs to be accommodated and the backup time provided to the SUs. An algorithm to find the backup time for a backup channel is proposed where it depends on the number of secondary users having the same transmission range and the number of available channels.

Input : *m*,number of available channels. number_SUs, number of SUs in the waiting queue in the network. backup_Toff, value of *Toff* of backup channel.
Output : *backup_time*, backup time of backup channel
if (number_SUs < =(m/2)) backup_time= backup_Toff,
elseif (m/2<number_SUs<=(m/2+m/4)) backup_time= ((m/2 + m/4)/m) * backup_Toff,
elseif ((m/2+m/4)<number_SUs<=(m/2+m/4+m/6)) backup_time= (m/2)/m * backup_Toff
else backup_time= (m/4)/m * backup_Toff,
end if
return backup_time;

ALGORITHM 3. Backup Time Calculation (m, number_SUs, backup_Toff)

Backup time depends on the number of available channels and the number of secondary users waiting for the channel in the same transmission range. The number of SUs that can be accommodated is depending on the number of active PUs, if all PUs is active there will be no room for SU hence a minimum number of active SU is zero. In the proposed model maximum number of secondary users that can be accommodated in the network is one less than the number of available channels, since at least one channel should be there to serve as the backup channel for the other SUs. In this way, more SUs can be accommodated but the transmission will become slow as only one backup channel is switching among the number of SUs. Only one SU will have transmission and others have to stop their transmission and wait for their turn to get back up channel hence throughput decreases. An algorithm (Algorithm 3) for backup time calculation is also proposed, if the number of available channels is twice the number of SUs, then a full-time backup channel can be allocated to the secondary user. As explained above if the number of SUs is increased, the backup time has to be reduced so that one channel can be served as the backup channel for many SUs. After allocating candidate and backup channels to the SU we can have two scenarios a) If PU appears on the candidate channel b) If the Backup time of the backup channel expires. If PU appears then the backup channel becomes the candidate channel and a new backup channel is found. If backup time expires then also we have to find a new backup channel. In the end of Algorithm 2, list of available channel is updated and an array of *Toff* of available channels is maintained. The channels are categorized on the basis of their usage are shown in figure 3. In the network, there are a number

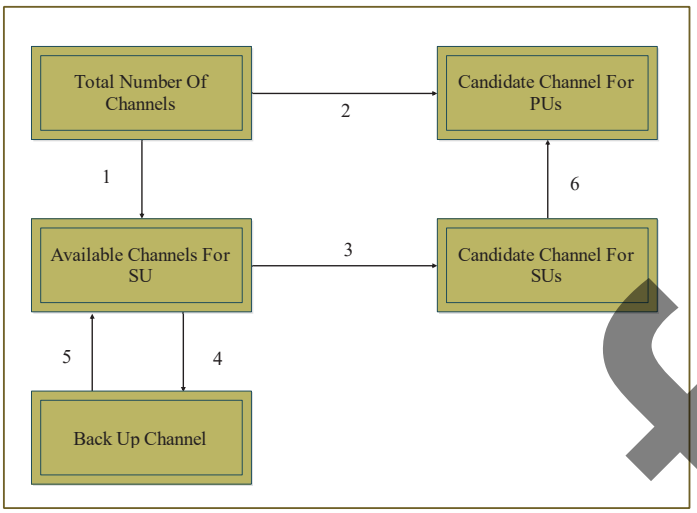

FIGURE 3. Cognitive Cycle in CRN

of channels and each channel has allocated to PU. When PU is transmitting on one of these channels, it is called the candidate channel for PU shown by arrow 2. In the proposed model, after providing the minimum time requirement for SU, available channels are found for SU transmission, shown by arrow 1. From these available channels, the best one for SU transmission is searched and referred it as a candidate channel for SU as depicted by arrow 3. The second best from the available channel list is assigned as a backup channel for SU transmission shown by arrow 4. Now, whenever the backup time expires the backup channel will go back to the available channel list and hence will be available to other SUs in the network. It can then serve as the candidate or backup channel for other SUs. If PU comes on the candidate channel of SU then SU will switch to the backup channel and the channel will become the candidate channel for PU as shown by arrow 6.

SIMULATION AND RESULT ANALYSIS

For the simulation of the proposed algorithms MATLAB is used. MATLAB provides the facility to implement algorithms, design and develop the user interface. Results can be analyzed by a plotting graph. In this research, an infrastructure-based cognitive radio network consisting of multiple SU with ten license users is considered. Assuming each primary user is designated to a particular channel, each SU is uniformly distributed over the network and all the channels have exponentially distributed ON/OFF periods. SU tries to exchange packets with its neighbor. A database is created randomly having the values of Toff (OFF period per hour) of different channels at different hours and stored which provides information about channel status to the different SUs whenever required. The created database has the status of ten channels for twenty-four hours. The database is created by considering the real-time scenarios. A day is divided into twenty-four hours and classification of hours is done on the basis of channel usage by PUs. Whenchannels are used by PUs extensively these hours are termed as peak hours and the value of Toff will be very less inthe range of 0 to 20 minutes. When channels are not used by PUs, they are considered as free and *Toff* is in the rangeof 0 to 60 minutes. When channel usage is moderate the range of Toff is 0 to 40 minutes. The results obtained by this database are more realistic. This database is updated hourly and should be shared among the SUs. The first step of the simulation is to load the database once it is loaded it can be used for the next hour. A list of available channelsis obtained by providing minimum requirements about the transmission of SU. The candidate and backup channels are determined from the list of available channels. Once the backup channel is found a backup time is assigned to it depending on the number of active SUs in the system.

PERFORMANCE ANALYSIS: BACKUP TIME CALCULATION

The prime objective of this work is to find the most appropriate channel for transmission, providing a backup channelto reduce the handoff delay and a varying backup time for the backup channel so that more number of SUs can be accommodated which in turn increase the utilization of spectrum and throughput of SUs. To provide a full-time backup channel to all the SUs is a challenging task as we want to accommodate more SUs in the network. Accordingthe Algorithm 3 the backup time will decrease as number of SUs increases as explained by Fig 4. Now if we keep onincreasing the number of SU in the network we can find the following change in backup time.

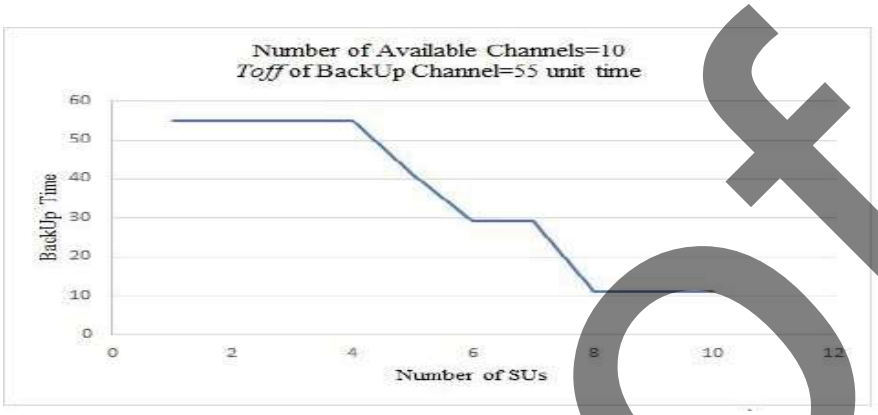

FIGURE 4. Variation in Backup Time on increasing the number of Secondary Users

Considering ten numbers channels, the minimum number of SUs is zero and the maximum is one less than the numberof available channels i.e. nine if a number of available channels are considered as ten (hypothetically). Variation in backup time as the number of SUs increases is shown in the above figure.

Spectrum Utilization

The utilization of the band can be improved if the PU and SU at the same time access the spectrum. In the simulated environment, two primary users are accessing their channels the remaining are spectrum opportunities for secondary users at that time. By introducing SU in the network, spectrum utilization can be im- proved. More the number of SU accommodated, the more is the spectrum utilization. The proposed algorithm uses varying backup times for the backup channel that improves spectrum utilization. Also by providing a backup channelsensing-based handoff can be avoided to some extent which in turn increases the performance of the network. The firstcomparison is done on the basis of the maximum number of secondary users that can be accommodated in the networkwhen the number of available channels is increasing. In the simulated environment number of PUs that reappeared ondesignated channels that are occupied by SUs is two, and the number of SUs having the same transmission range andare in the waiting queue is five. Out of these five SUs maximum of three are accommodated if varying backup time isused while only one SU can be accommodated in fixed backup time as shown in Fig 5.

The behavior of PU in CRN is uncertain, also we can't predict its activity accurately. If the number of PUs reappearedat different intervals of time in the network then the number of SUs that can be accommodated will vary depending upon the number of PUs. As the number of PUs is more, less is the number of available channels and hence less the number of SUs can be accommodated as shown in Fig 6. By providing a backup channel the unnecessary sensing- based handoffs which may occur due to the uncertain behavior of PUs can be avoided. A number of predetermined spectrum handoff is there which helps to avoid sensing-based handoff. Sensing-based handoff degrades the perfor-mance as it increases the handoff delay in comparison to predetermined spectrum handoff.

Because the throughput of PUs is not anticipated to be impacted by the SUs' activities, the throughput gain of the network in a cognitive radio network primarily depends on the throughput gain of SUs. The throughput of the cognitive radio network is therefore only taken into account in this work as the throughput of SUs. As the above graph shows, the number of accommodated SUs is more in varying backup time as compared to fixed backup time even if the number of PUs reappearance instances is more. This simulation results show varying backup time provides better

spectrum utilization

FIGURE 5. Number of SUs accommodated in fixed and varying backup time.

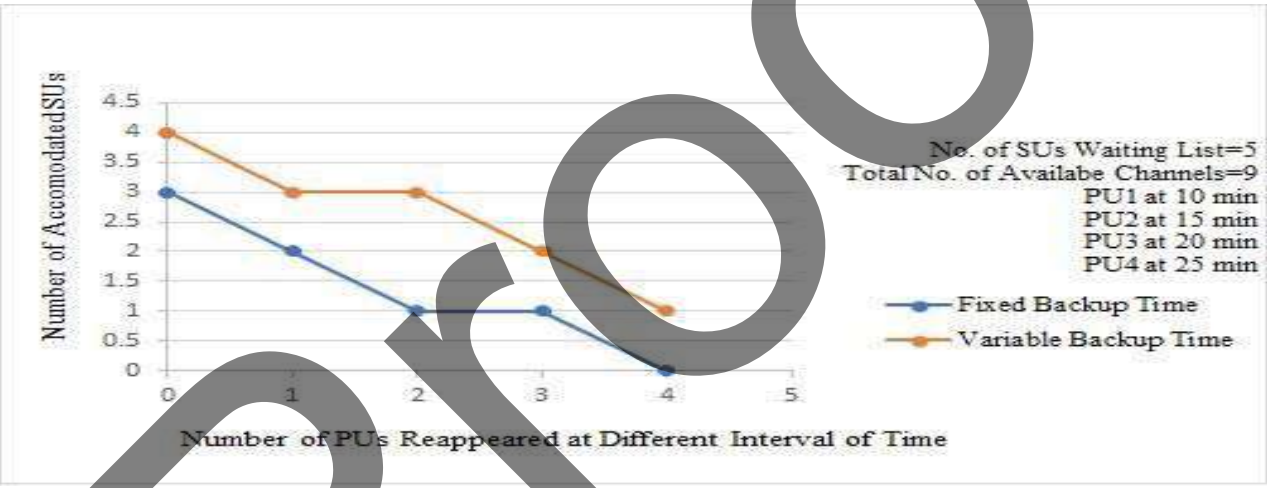

FIGURE 6. Number of accommodated SUs with increasing number of PUs reappearance.

by accommodating more SUs, avoiding sensing-based handoff, and improving the throughput of the network in com-parison to fixed backup time. Hence the overall performance of the network can be improved by assigning a varyingbackup time to the backup channel.

CONCLUSION

An developing technology called cognitive radio has the potential to address the issues of spectrum inefficiency and spectrum scarcity by allowing a group of secondary users (SUs, or unlicensed users) to opportunistically utilise the spectrum allotted to a main user (PU, or licensed users). However, due to the shifting nature of the available spectrum, SUs face a variety of difficulties. In this work, a proactive spectrum handoff technique with the prediction-based model is discussed. Algorithms to determine suitable channels immediately afterspectrum handoff are proposed. Handoff delay can be decreased considerably by providing a backup channel in the process of spectrum handoff. Moreover providing a backup time to backup channel further improves the performance.Backup time assigned to a

backup channel can either be fixed or varying with some parameters. An algorithm to determine the varying backup time is proposed here. There must be a tradeoff between the number of secondary userswe can accommodate and the extent to which backup time can be decreased. A comparison between varying and fixedbackup time is done here and simulation results show varying backup time is better in terms of spectrum utilization. Future work includes designing a model which is not prediction-based as prediction has its non avoidable errors andthen find the backup channel and backup time. In the proposed work it is assumed no transmission without backup channel, in future this work can be extended by providing a strategy where a channel can serve as common backup channel for number of secondary user simultaneously. It will improve the performance of network. Also in this work,the candidate and backup channel are selected which are having the maximum and second maximum value of Toff can be called as first fit. If exact requirement of SUs is determined then these channels can be assigned on the basis of requirement. The most appropriate channel according to the requirement will be determined and assigned as the candidate or backup channel can be termed as best fit.

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Online Frauds Detection using Machine Learning Techniques: A Review

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Abstract. Online transactions and shopping make the life of urban cities more comfortable. But this system is not full proof there are various flaws due to which hacker can steal all the hard-earned money is very less amount of time. The need for earlier detection of online frauds is increasing day by day. Online fraud refers to frauds when product bought online is of cheap quality or the money from one account is robbed. In this paper, we are going to discuss various types of online-based frauds and their detection using machine learning. Accuracy is also an important factor while discussing online frauds in this paper we are also going to discuss various methods used to calculate the accuracy.

INTRODUCTION

The online transaction has become an important part of this modern world. Online purchasing is quite popular since it provides the availability of a variety of goods in an easy manner where you can get anything at a click of a button. Frauds can be defined as a situation when stolen data can be used online while buying or when a buyer has to pay more than the actual price. The following are a few types of online frauds such as credit card frauds, email frauds, online auction frauds, and many more. The process of fraud detection was done by financial analysts traditionally. But as the number of online transactions and nature of the fraud becoming more complex it is almost impossible to do this process manually. To solve this problem machine learning can be used, machine learning as the procedure to provide machine the ability to learn from the data without being explicitly programmed. Machine learning is mainly of two types Supervised and Unsupervised Machine learning. Supervised machine learning works on labeled data it is of two type regression and classification. Unsupervised machine learning works on unlabeled data and uses two approaches clustering and association. Machine leering can be used as the size of the data is increasing. There are many difficulties faced during the time of data collection. The data contain much sensitive information because of these banks are not ready to provide the real data. The data is dynamic which means it will change with time. To collect data sometime a joint committee is made to get data from the bank or merchant and sometimes synthetic data can be made. After the data collection, we have to perform preprocessing as the data is highly imbalanced since the number of frauds is less as compared to the legitimate record.

This paper is articulated as follows: Section II describes the various Machine Learning Techniques. Section III describes the types of frauds. Section IV describes the literature survey. Finally, Section V represents the conclusion.

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MACHINE LEARNING TECHNIQUES

Machine learning is the subset of AI which helps the machine for decision making without human intervention. Machine learning provides accurate output in a very less amount of time. It is used in many fields from image recognition to the recommended system. It can be proved to be quite useful in the case of an online fraud detection system. The number of transactions per day has to reach a billion it is vital to block the fraud transaction and allow the authentic one. Based upon the type of input provided it can be categorized into two types Supervised and unsupervised machine learning. In the case of supervised machine learning algorithms input is provided as labelled data. In the case of unsupervised machine learning unlabelled and majorly problem is solved using clustering and association.

Following are the types of supervised machine learning algorithms.

A. SVM: Support Vector machine is mostly used technique which can be used for both regression and classification problem. SVM uses a simple probabilistic approach in which it assumes that the data belonging to the different classes should be as far as possible. SVM can work on both linear and nonlinear data by changing the value of the kernel. The computation time is very high in the case of SVM while the accuracy is high too. SVM is affected by the noise badly.

B. Decision Tree: It is one of the simplest algorithms to be used. It uses simple if and then rule to classify the data into a different category. It provides fast and accurate results. As the name suggests the flow is according is in the form of a tree the internal nodes represent the condition while in the leaf node we assigned a category to each value. The prominent problem in the case of the decision tree is overfitting in which the machine learns the training data very much. In this case, the accuracy is very high in case of training data but in case of testing data, it drastically fails.

C. Random Forest: It is a type of ensemble machine learning which works on a voting system in which the decision is a collective one. It uses many decisions to make the final decision due to which it can deal with the missing data very easily. But the computation time is very high and the memory usage is very high as well. As a very high number of computations to be performed the decision is quite slow.

D. KNN: KNN stands for K nearest neighbor where K is the number of neighbors which is to be considered while deciding for categorization. The computation time is quite low and it can be easily used. In the case of KNN for regression mostly Euclidian in case of regression while in case of classification hamming distance is used.

E. Naïve Bayes: Naïve Bayes uses Bayesian to predict the result. The basic assumption it takes is that all the features are independent of each other. It is simple to implement and gives better accuracy in less amount of time.

F. Deep learning: Deep learning is a subset of ML that uses the concept of an artificial neural network. It mimics the working of the human brain during decision making. Artificial neuron network consists of the various layers in which the first layer performs the input. Various hidden layers are involved while making any decision. The time and data requirements are quite high in the case of deep learning models. Sometimes special processors are also required to provide the required processing.CNN is one of the popular deep learning algorithm used in feature extraction.

G. Hybrid approaches: Since there are various limitations such as over fitting in the case of individuals algorithm to cope up with these limitations we use a hybrid approach.

The following are some of the hybrid approaches used in the case of online fraud detection techniques.

- Fuzzy based decision: It was proposed to detect credit card based frauds. It is a hybrid approach using both the property of decision tree and fuzzy logic. Fuzzy logic is used to deal with inaccurate data. It makes uses of membership function whose value ranges from 0 to 1.

- Hybrid of RF and SVM: It uses the combination of the Random Forest and Support Vector Machine. Feature selection can be done using random forest and on selected SVM is applied to provide the result. Its performances are higher as compare to a random forest and individual decision tree. It can deal with both the missing data and noise efficiently.

- Deep learning hybrid approach: Deep learning makes use of artificial neural network which work in many layers. To develop an artificial immune system for video on demand system we make use of hybrid approach consisting of CART(Classification and Regression Tree), DCA (Dendritic Cells Algorithm) and CSPRA (Conserved Self Pattern Recognition technique).

- Fraud BNC: It uses both the concept of the Naïve Bayes algorithm and the Hyper-heuristic evolutionary algorithm. The main concern was the transactional amount and cost-effectiveness. It was used on Brazilian data given by PagSeuro.

- Bagging and decision tree: Over fitting is the major problem for decision trees. To enhance the model stability we combine both bagging and decision tree. The hybrid model has better accuracy and less computational time. Since the data for online fraud detection is highly imbalance this method proves to be quite useful.

TYPES OF FRAUDS

Following are the types of Frauds normally encountered in online transactions:

- Credit card-based: Credit card is one of the most used online methods to perform an online transaction. Credit card is of two types CP (credit card present) and CNP (credit card not present). CP can be easily detected as in this case credit card is physically present it take mostly during ATM transaction or swapping card. CNP is difficult as in this case the card is not present physically.

- Online auction-based: Auction sides like eBay provide sellers a platform to sell their products for the best price. Sometimes the seller uses the illegal way to enhance their rating as mostly buy products that have a greater number of reviews. They use the fake id to increase the price of their product as a result of which the buyer has to pay an extra amount. The platform wants to avoid third as this will result in loss of trust which will lead to customer loss Email Based Frauds Email stands for electronic mail. Electronic mail is one of the fastest ways to communicate but it is also one of the most ways in which hackers can perform online frauds. Malicious code can be sent with the help of mail which can bypass the security firewalls also. The number of malicious mail sent every day is about 45 billion.

- URL Based Frauds: URL is one of the most important parts of the websites it stands for Uniform Resource Locator. As the number of users over the internet is huge the URL based frauds are also increasing. This malicious website is contained on another website because of which when the user visits a familiar website he ends up giving data to some other website that may misuse the information provided by him.

LITERATURE REVIEW

The usage of machine learning in the field is quite an old concept but due to the increase in the data and high processing, this seems to be more demanding in the future. To deal with the CNP (card not present) frauds

[1] Uses linear regression. It compares various strategies in which a "merchant's best strategy" outperforms the rest. This algorithm is best suited for a single merchant and his customer and works on static data.

[2] Deal with the credit card based fraud using European dataset. As in this type of system, the interaction between the system and user is for a short duration therefore their paper compares various algorithms based on time, sensitivity, and precision. As a result, they get the decision tree as the optimal choice since it takes less time to execute. [3] Works on the combination of a dataset of fraud transactions and the dataset is quite imbalanced. After the data preparation, the dataset is reassembled using condensed nearest neighbor and random under sampling(for under-sampling) and synthetic minority oversampling technique (for oversampling).It uses a 10 fold cross-validation technique. [4] Uses the Kaggle dataset to compare various datasets. In this, the number of fraud transactions is less and they divide the dataset by themselves. To evaluate the result, it uses confusion matrix and classification accuracy. The most promising result is given by logistic regression.

[5] Uses 284,807 transactions in which only 0.172% is fraud transaction. They use the PCA variable to calculate the mean and check the imbalances in the dataset. While comparing many supervised machine learning algorithms it is observed that logistic with SMOTE gives the best accuracy of 97.04%.

[6] Uses the European dataset in which the SMOTE technique has been used. There are about 5962 transactions in the dataset in which only 92 are frauds, so preprocessing is required. The best result came from Random forest i.e. 99.96% accuracy. As the data of credit card detection is highly imbalance, many algorithms seem to categorize legitimate transactions but not the fraud one.

[7] Proposes their basic concern to protect the customer from a bad experience by preventing fraud related to cards. This model uses a consistency score for each data value according to which legitimate data set will have a higher score. It uses the KNN algorithm and evaluation is made using AUROC and AUPRC graph

[8] Explains various papers use the European dataset which contains very less amount of fraud. It also explains various challenges while dealing with Credit card fraud detection. In this, two types of learning are used- static learning and incremental learning for each algorithm. In this, logistic regression has 0.843 % AUC score (for incremental learning) which performs quite well but since the dataset is static, it must be cross-checked on the realistic data.

[9] Focuses on developing the system for the credit card risk identification method. It uses a combination of random forest and supports vector machine. As compared to the various algorithms, the accuracy is low but the sensitivity is quite high. It helps the company to reduce the cost of investigation as the no. of false positive is less.

[10] Deals with URL based frauds using about 331,622 URLs from Phish tank and 360 securities. It explains various categories of features in the URL and the characteristic of the URL. While dealing with the dataset it employs various data transformation ranging from singular value decomposition. Its only limitation is that it doesn't deal with the amount of time require.

[11] Paper proposed a hybrid algorithm embedding artificial immune system for video on demand system to log data. In this, CSPRA (conserved self pattern recognition algorithm), CART (classification and regression tree), and DCA (dendritic cell algorithm) are used. By using the hybrid approach, high true positive, low false-positive rate, and high dimensionality can be achieved.

This paper uses a hybrid approach consisting of a decision tree and fuzzy logic

[12]. To reduce the over-fitting, post pruning is used which will minimize the error values. The information gain is used to check for a conditional attribute. It proved to better than other machine learning algorithms with an accuracy of 98%.

[13] Deals with the largest dataset from a Chinese bank having 114,779 transactions in which there are 2062 fraud transactions. As the number of fraudulent transactions is very less, it is a highly imbalanced dataset. It uses three deep learning algorithms DBN, CNN, and RNN. In this, we compare two feature engineering approaches which are HOBA and RFM and by comparing both of them, it was found that HOBA is more useful. In the proposed model, DBN achieved the highest accuracy of about 98% with 3% false-positive rate, the only thing that is not considered is the computation time.

[14] Uses Pagesuero (Brazilian online payment service provider) data set for creating customized Naïve Bayes techniques. It uses an HHEA (hyper-heuristic evolutionary algorithm) which collects information about Fraud BNC and gives the best combination of the dataset according to the components for a given dataset. The proposed system provides an economic efficiency of about 72.64%. Economy efficiency is defined as how the company is being affected by the model.

[15] Proposed a model using a neural network and SOM (self-organizing map). Working with the SOM sub-layer is quite important to recognize the fraud transaction. Clustering on the input data is used to identify the fraud transaction which cannot be recognized otherwise. The sensitivity of the model depends upon the clustering so the cluster center and tolerance radii should be chased after visualizing the dataset.

[16] Uses different cases but as the computation time is a very large, bagging ensemble-based decision tree is used to detect credit card based frauds. It uses two standard metrics i.e. MCC and BCR. It is found stable and fast on the dataset provided by UCSD as time is an important factor while analyzing any model. The decision tree is a good choice since the data is highly imbalanced and the decision tree can reduce the over-fitting, and can easily deal with the imbalance data.

[17] Uses the dataset provided by a Chinese firm that provides the services for the master/credit card. It is based on fraudulent cash out frauds. It considers both the dynamic behavior pattern and a snapshot. It uses three machine learning algorithms which are XgBoost, SVM, and random forest. In this approach, the time required for computation is not considered, and further work can be done using feature reduction.

A supervised learning algorithm is performed to remove fraud cases in online auction sites

[18]. The classifiers used in this were Naïve Bayes and SVM. The accuracy shown by Naïve Bayes is 79.26% and that of SVM is 85.08%. Detection of phishing websites can be done using deep reinforcement learning as in [19].

For this purpose, the Ebbu2017 phishing dataset is used which has 73,575 URLs. The accuracy shown by reinforcement is 90.1%. From the phishing URLs that were submitted between June 2016 and August 2016, compromised URLs can be identified

[20]. This dataset has 405 URLs. For this purpose, the Naïve Bayes classifier is used as it has good accuracy. Machine learning techniques can be used to detect fraud from list of Malicious and Benign URLs

[21]. The different methods used in this are as follows- RF, DT, Logistic Regression, KNN, and SVM. The highest accuracy of 96.58% is shown by the RF classifier.

CONCLUSION

Machine learning is a vital branch of AI which helps the system to decide by them. One of the most important applications is online fraud detection as security is the main concern as the data over the internet is increasing rapidly. Efficiency is an important factor when we are dealing with e-commerce websites as a wrong decision can ruin someone's experience with an online purchase. In this paper, the various methodologies have been compared for various online frauds ranging from URL based to credit card based. Individual algorithms have various drawbacks in this case hybrid approaches prove better. Hybrid approaches can combine various advantages of individual system and produce an overall better accuracy. Further improvement is required in this field so that the new algorithm can deal with the dynamic data set and imbalanced data set in less computational time.

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A Comparison Study of Three Photovoltaic Technologies in Jordan Climate

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Abstract. The wide use of renewable energy technologies, especially photovoltaic system technologies is required to know and find the main factors and parameters for the productivity and efficiency. This paper presents the real and decisive parameters for generating and harvesting the maximum energy from three different kinds of photovoltaic technologies, which are the (Poly-Crystalline, Mono-Crystalline, and Thin Film cells) based on the conditions of the Jordanian Climate. In this work, a real data was generated using installing the three different kinds of PV technologies in three districts in Jordan (north, middle, south) to customizes the best technology with the optimum azimuth and tilt angle. This wok shows that the optimum technology in north is (mono-technology) with optimum tilt angle (15◦), in middle is (mono-technology) with optimum tilt angle (10◦), and in south is (m0no-technology) with optimum tilt angle (19◦).It is known that the energy generated by the same renewable energy technology varies by location. Likewise, the energy obtained from two different technologies may differ in the same location even if both systems have the same nominal capacity. It is the target of this paper to collect the actual and the accurate data of two photovoltaic systems with the same nominal capacity but use two different technologies. This is accomplished by installing different systems in the same location, studying the environmental and weather effects on energy production and quality while collecting real data that will be used later for further investigation. Finally, a comparison of technologies and how they withstand environmental conditions in Jordan is silicon and thin film silicon photo voltaic panels.

INTRODUCTION

In 2017, Jordan came the first on renewable energy growth on the Arab world (middle east and north Africa) and the third world wise [1], therefore the argue for Jordan geographic and weather effecting on the different types of technology is necessary, specially that Jordan sunny days are 300 days in the year[2], and has combination of Mediterranean climate and arid desert climate.

As known, there are three types of photovoltaic technology, Mono Crystalline, Poly Crystalline, and Thin Films (Low usage) . Mono Crystalline are made of single crystals, Poly Crystalline from multiple crystals, and thin films from Amorphous Silicon. Thin films technology considers the newest technology, but the least efficient and the least used in Jordan. Poly and mono technology are commonly used in the photovoltaic systems in Jordan and in the whole world, in spite of the difference of their manufactures and their performance ways, but eventually, they serve the same purpose.At the standard temperature 25◦ C – Solar Irradiance 1000 Watts per square meter – air mass 1.5) Mono condition (cell Crystalline is the most efficient but in a different condition's they will act differently [3], so in this paper we will study the way that every technology act in different condition in north, middle and south Jordan and determine the best technology and best tilt angle at each.

This study would be the first of its kind in Jordan, as there is a previous study that studies the difference between mono and poly technology, but only for three months, and only in Amman [4], and there is a study that defines the best tilt angle, but only in north Jordan [5], and by Depending on simulation data, not a real data.

Nomenclature

P	Kilowatt peak production
H	Kilowatt-hour production per month
R	real peak usage for the panel capacity
N	number of panels

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T Optimum tilt angle

L Latitude

G KgCO_2 saved

V KWh produced

β 0.2831

α : Normalizing PV capacity factor

RESEARCH METHOD

In order to see the different technology real behavior at each region, we have taken real data from a really different projects that had been using (mono-ploy-thin film), and take simulation data in order to compare the result and come out with a result that can helps to determining the best technology to use at each region.

In order to cover all the factors that can affect the performance of the PV systems, we should see how the difference in the tilt angle values can effect on the productivity.

In order to determine the actual KWP that the project produced in a year we used equation 1.

$$P = \frac{H}{130 * 12 * 0.98} \quad (1)$$

And in order to calculate the real usage for the panel capacity, we used equation 2

$$R = \frac{P}{N} \quad (2)$$

In northern regions of the equator PV panels should be directed to the south[4], in order to have the best performance, as a result of the earth moving around the sun, the irradiation falls in different angles through the year, so we have different optimum tilt angles valued in each season, and we have an average angle we can use it in a fixed systems.

The optimum tilt angle depends on the latitude values.so we can calculate the optimum tilt angle in Jordan using the following equation and the simulation results shown in table 1

$$T = (L * .76) + 3 \quad (3)$$

Table 1. The optimum tilt angle in Jordan according to latitude value

Region	T
North	27◦
Middle	27◦
South	26◦

In order to see the effect of changing the tilt angle on the PV systems, we have taken real data projects in different regions in Jordan, north, middle and south, with different tilt angles, to see at first the behavior of the fixed project at the different tilt angle values.

RESULTS AND DISCUSSIONS

First case middle of Jordan (Amman)

As we see in table 2 the peak power of one panel of poly panel technology (270,320,250) watt respectively gave a different real peak power in the same conditions of climate and the same region (Amman), so we can note that the poly with peak power 250 W gives in the fact 263.9688213 W this mean that the extra peak power reach to 5.2918% which has the large power (energy yield) of this type with its identical type, even though it is less of nominal peak power and less of tilt angle with comparing by theoretical optimum tilt angle, which is mean there is no effect of increasing tilt angle to the optimum value in this case as the theoretical studies proof, so we can put the poly type with tilt angle 10◦ in the first one which gives extra energy yield of its peak power capacity, as shown in fig.1.a.

Table 2. Different projects data of three type of panels in Amman

Project No.	Location	Panels Technology	KWP	Real KWP	Extra KWP%	WP of one panel	Real WP of one panel	Extra WP% of one panel	Tilt Angle	Optimum tilt angle
1	Amman	poly	4	3.923487	-1.9501%	270	261.5658	-3.2245%	15◦	27◦
2	Amman	poly	4	3.780743	-5.7993%	320	315.0619	-1.5673%	29◦	
3	Amman	poly	31	32.7321338 5	5.291845%	250	263.9688213	5.2918%	10◦	
4	Amman	mono	31	35.5963637 2	12.91245%	285	323.6033065	11.9292%	10◦	
5	Amman	Thin film	75	69.7376779 8	-7.5458%	170	169.6780486	-0.1118%	1◦	

Now we should to compare different types of panels (poly, mono) in the same condition and the same tilt angle, so that we should to equal the values of watt peak of one panel of these types by finding the factor which make its equal.

We can find the ratio between the big value and the small value of WP from the following equation

$$\alpha = X1 \div X2 \quad (4)$$

α: Normalizing PV capacity factor
X1: the larger power capacity size of the pvpannel.
X2: the smaller power capacity size of the pvpannel.

By applying the eq.4 we find the factor α between poly 250w and mono 285 is equal to1.14 so the values change as we can see in table 3

Table 3 Two type of panels in Amman

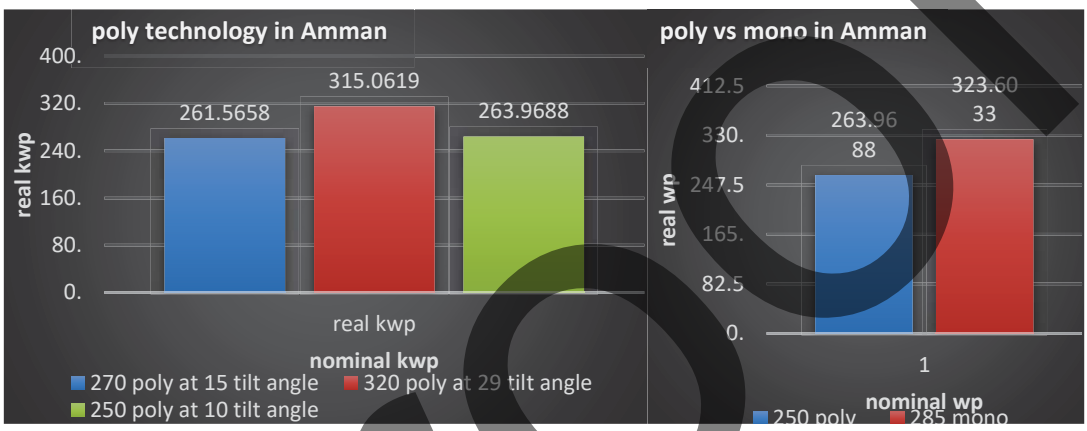
WP of one panel	Real WP of one panel	Extra WP% of one panel	Tilt Angle
250 poly×1.14=285	263.9688213×1.14=300.924	5.2917%	10◦

285 mono	323.6033065	11.9292%	10◦

Now we can compare two different technologies with convergent value of peak power capacity of one panel (250 W of poly, 285 W of mono) and with the same tilt angle 10◦ at the same conditions of climate and the same region (Amman) as shown in table2.

We can see the poly of 250 W gave an extra energy yield in fact with 5.2917% extra power, but on the other side the mono type of 285 W gave an extra energy yield in fact with 11.9292% extra power in the same conditions of climate in Amman, so the performance of mono type is the best in this region absolutely as shown in fig.1 b.

In the other side There is no extra power of peak by using the thin film type in Amman as we see in table 2, because the performance of this technology hasn't reach to peak power value as we can see in real data of this type, thin film of 170 W peak power gives 169.6780486 W less than of its peak value of power with -0.1118% as shown in fig.1.c, until if we found the factor α, it was still with minus value. so by default the performance of mono type in Amman is the best choice to get more efficiency and energy yield.



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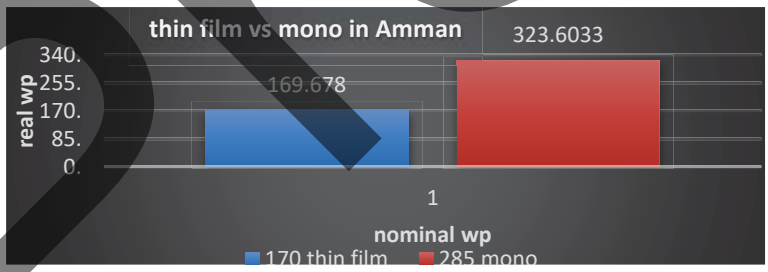


(c)

FIGURE. 1. (a) Poly technology in Amman; (b) Poly vs mono in Amman; (c) Mono vs thin film in Amman.

Second case north of Jordan (Irbid)

Three panels of mono have (340,290,290) W gave different values of real peak power as shown in table 3, 340 W mono panel with tilt 9◦ gives 335.343283 W which is less of its nominal peak value, but the 290 W mono panel with tilt 7◦ and 15◦ give extra energy yield of their nominal values at the same conditions of climate in Irbid, this is leading to search of the causes of different performance of the same type in the same region. if we look out to the tilt angle of

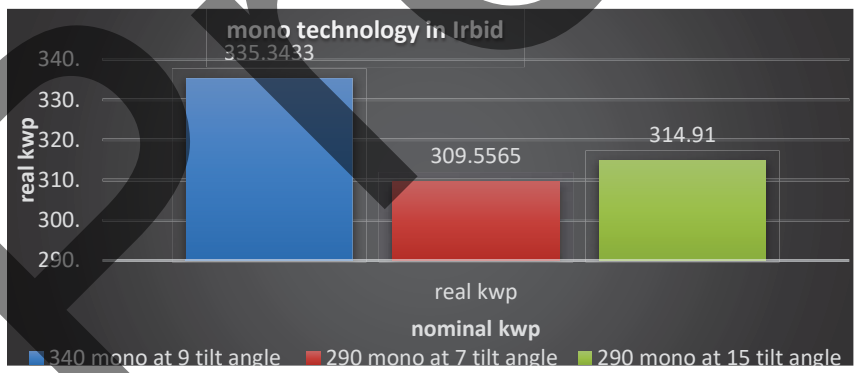
every panel of 290 W mono type, we can note that the 15◦ of tilt angle has extra power of panel with 7.9117%. this leads to know the effect of increasing tilt angle on mono type performance in this region (Irbid) as shown in fig 2. (a).

To complete the comparison between two different technologies (mono vs poly), we should equal the nominal power of one panel of each type. In this case we have 290W of mono with highest extra WP% and 325W of poly, so we should find the normalizing PV capacity factor(α) and then calculate real power depends on the value of (α) and calculate the real power percentage to comparison.

With applying eq.4, the normalizing PV capacity factor is 1.1206 so the real power of one panel equal to 352.8939 with extra power percentage of 7.9043%. After integrating the result, the mono type still the best choice with extra power percentage 7.9117% in Irbid at the tilt 15◦ as shown in fig2. (b).

TABLE 4. Different projects data of three type of panels in Irbid

Project No.	Location	Panels Technology	KWP	Real KWP	Extra KWP%	WP of one panel	Real WP of one panel	Extra WP% of one panel	Tilt Angle	Optimum tilt angle
1	Irbid	mono	74	72.76949241	-1.6909%	340	335.343283	-1.3886%	9◦	27◦
2	Irbid	mono	35	37.146782	5.7791%	290	309.55651	6.3175%	7◦	
3	Irbid	mono	15	16.37559	8.4002%	290	314.9152	7.9117%	15◦	
4	Irbid	poly	104	112.0905285	7.2178%	325	350.2829016	7.2178%	10◦	
5	Irbid	poly	520	499.0764	-4.1925%	330	326.8346	-0.9685%	6◦	
6	Irbid	Thin film	Not available in Irbid							



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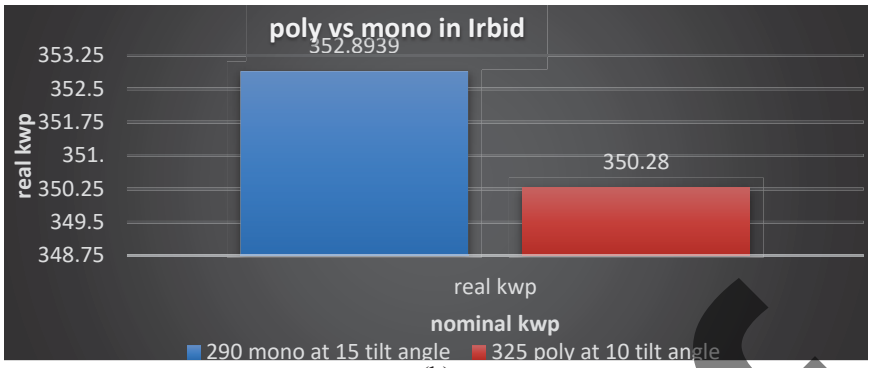


(b)

FIGURE. 2. (a) Mono technology with different tilt angle in Irbid; (b) Poly vs mono technology in Irbid

Third case south of Jordan (Maan)

With looking to table 4 specifically to the poly panels which have peak power capacity for one panel (330,330,320) W respectively, the real power capacity of poly technology in Maan city has more than its nominal value reaches to 23.2376% at 19◦ tilt angle. But on the other hand the poly panel of nominal power capacity 230 W has a real power capacity 242.9042386 W with percentage of 5.3124% only, this caused by the difference of tilt angle which is 27◦, this performance of poly panel depends on the tilt angle value in this region, as we note that the optimum tilt angle of Maan can't has high of energy yield as the theoretical proofing of optimum tilt angle.so for this result we can say that the effective performance of poly panel in Maan has tilt angle less than the theoretical value of optimum tilt angle it is near by 19◦ as shown in fig3. (a).

TABLE 5. Different projects data of three type of panels in Maan

Project No.	Location	Panels Technology	KWP	Real KWP	Extra KWP%	WP of one panel	Real WP of one panel	Extra WP% of one panel	Tilt Angle	Optimum tilt angle
1	Maan	Poly	5.28	6.600601779	20.0077 %	330	412.5376112	20.0072 %	4◦	26◦
2	Maan	Poly	5.28	6.787676609	22.2119 %	330	424.2297881	22.2119 %	19◦	
3	Maan	Poly	5.12	6.6699372	32.2396 %	320	416.87108	23.2376 %	19◦	
4	Maan	Poly	1	1.214521193	17.663%	230	242.9042386	5.3124%	27◦	
5	Maan	Mono	5.11	7.0885662	27.9235 %	365	506.32616	27.912%	19◦	
6	Maan	Thin film	1	1.10012428	9.1011%	70	73.3416187	4.5562%	27◦	

According to the analyses of poly performance in Maan city, we need to compare it with other type of technology (mono panel) at the same conditions of climate in Maan. The mono panel with 365 W peak power capacity of one panel gives 506.32616 W real power in fact with increasing percentage of 27.912% at the same tilt angle 19◦, this result means that the mono technology gets the better performance than the poly technology in the same conditions and tilt angle in Maan.

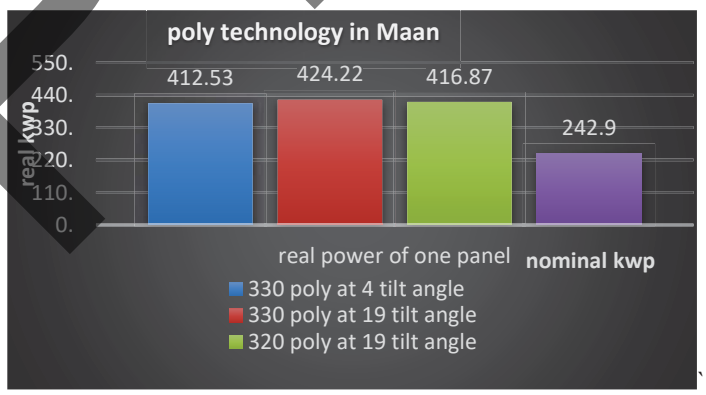
So to correct the parameters which we need to compare it, we should the normalizing PV capacity factor between two type depends on equation 3, Which is proof the result we obtained, because it still less than the percentage of mono which is 27.912% as shown in table 5 and fig3. (b).

To achieve an accurate result in comparing analyses we find the normalizing PV capacity factor between mono with poly and between mono with thin film, then multiply the ratio to the nominal power of poly and thin film which is the has less nominal watt for one panel to equal it with the nominal watt value of mono, and multiply the ratio by the real power of poly and thin film and calculate the extra power percentage of them as shown in table 6.

TABLE 6. Integration of three type of panels in Maan

Project No.	Location	Panels Technology	WP of one panel	Real WP of one panel	Extra WP% of one panel	Tilt Angle
1	Maan	ono	65	506.32616	27.912%	19◦
2	Maan	oly	365÷320=1.1406	416.87108×1.1406 = 475.4932	23.2376%	19◦
3	Maan	hin film	65÷70=5.21428	73.3416187×5.21428= 382.424	4.7736%	27◦

With focusing on the extra power percentage, as shown in table 5 we find the mono percentage still the best with 27.912% extra power for one panel at 19◦ tilt angle, poly gives 23.2376% extra power for one panel at 19◦ tilt angle, and thin film gives 4.7736% extra power for one panel even though the tilt angle of thin film near by the optimum value at 27◦ as shown in fig3. (c). This results indicate to the mono technology in Maan gives the best energy yield at tilt 19◦ so the increasing of the value of the tilt angle near by the optimum tilt as the theoretical studies proof has no effect in this case in fact as we see in the performance of thin film at the optimum tilt angle 27◦ and in poly with 27◦ which have the less energy yield at 27◦tilt angle



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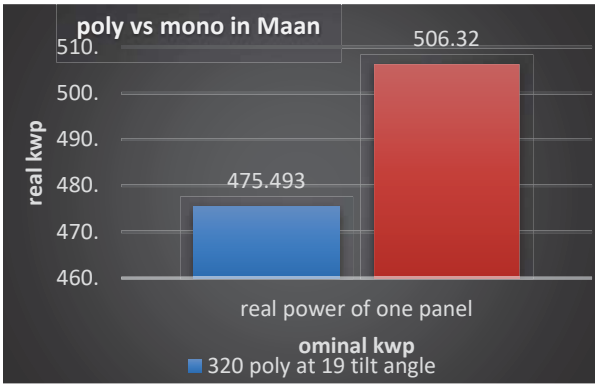

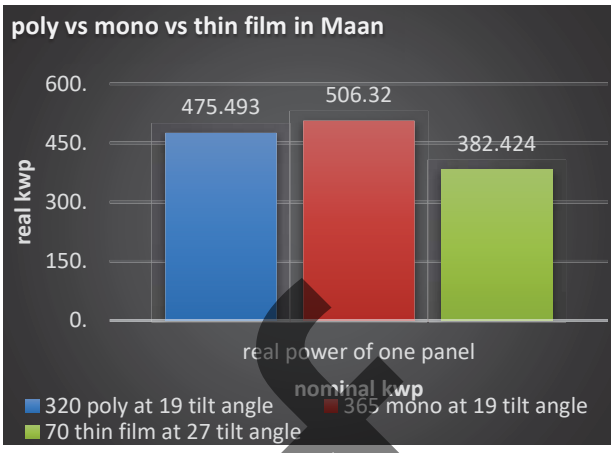

(b) (c)

FIGURE 3. (a)Poly technology comparison in Maan. (b)Poly vs mono comparison in Maan. (c) Three type of panels comparison in Maan.

We should mention that the extra real power capacity of panel values varies not just by changing the panel technology, it changes by changing the panel manufacturer, type of inverter, cables, maintain proper procedures during installation, operation, and maintenance, so we compared the projects that have the same technology, region, inverter type, cables (AC and DC), and have been installed by the same company.

Comparison with the best performance of panels technologies in different regions of Jordan

After studying the results of the best performance of three type of technologies in north, middle, and south separately, we should compare it with different location. The mono technology gives the best result in each region as shown in table 7.

TABLE 7. The best mono performance in north, middle, and south of Jordan

Project Name	Location	Panels Technology	WP of one panel	Real WP of one panel	Extra WP%	Tilt Angle
mono	Amman	mono	285	323.6033065	11.9292%	10◦
mono	Irbid	mono	290	314.9152	7.9117%	15◦
mono	Maan	mono	365	506.32616	27.912%	19◦

As known the panel capacity represent watt production per each peak hour under standard conditions, but if the cells sensed the sunlight in better conditions, or it sensed the sunlight for more hours than the average peak hours, then the panel can produce more wattage than its capacity, so the values which are over 100% are normal and acceptable, it refers that the system has produced more than its peak capacity, in this case the mono technology is the best in Jordan specially in south of Jordan in Maan as we seen in table 6 and shown in fig 4.

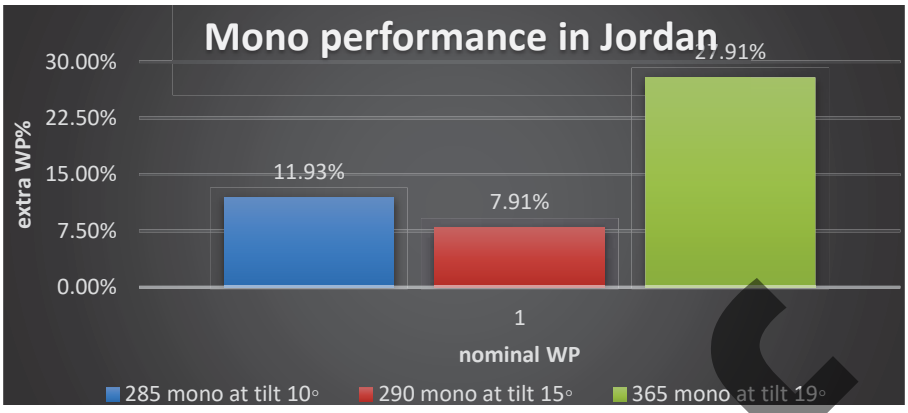

FIGURE. 4. Mono performance in Jordan.

Environmental Impact

Population numbers growth in the cities every day, which case the increase of carbon dioxide, which is going to contribute global warming issues and expansion ozone hole, Jordan for sure, is contributed to stopping this by signing on Paris agreement for climate change [6], this means that the renewable energy community in Jordan should make wise choices when it comes in the technology type of panels. Since fuel production for electricity would increase the carbon dioxide and affect the global warming badly, green energy would reduce the carbon dioxide, and helps reduces the cases that increase global warming, you can see in equation 6 that every kWh PV produce would save 0.2831 Kg of co2 from the dioxide.

$$G = \frac{V}{\beta} \tag{5}$$

So, the right choice of the type of technology would help the environment, by increasing the kWh produced, then saves more kg of co2. If we apply equation 6 on the projects in 2.2 you can see that the right choice of the panel can affect the percentage of saving the kg of co2 /kWh, look at fig.5.

FIGURE. 5: The percentage of the kg co2 saved / kWh

It is known that using clean energy helps to reduce co2 emetine, which will help in reducing global warming, but does global warming has an effect on the PV system production?

In order to know we studied the differences between three types of irradiation at each region - which they are varies in the population numbering, and see why there is a difference in the absorbing irradiation between them, using NASA data for the year 2018 [7]

In order to study north middle and south Jordan we have taken a central point at each region

In the north of Jordan, the central point was in Al-Ramtha city with a Latitude: 32.2126, Longitude: 36.1720, and an Elevation: 752.73 meters.

In the middle of Jordan, the central point was at south Amman city with a Latitude: 31.8617 Longitude: 35.9245, and an Elevation: 289.06 meters.

And in the south of Jordan, the central point was at Maan city with a Latitude: 30.0182 Longitude: 35.4678, and an Elevation: 728.22 meters.

Download Thermal Infrared (longwave) Irradiative flux

Definition

- Thermal Infrared (long wave) Flowing average at morning hours towards a specific area (m^2) on the earth from the sun at each day.
- Downward Thermal Infrared (Longwave) Irradiative Flux Unit: kW-hr/m^2day.

Fig..6 and table 8 show the minimum and the maximum values of the monthly downward thermal infrared (longwave) irradiative flux Average in (2018) in north middle and south Jordan.

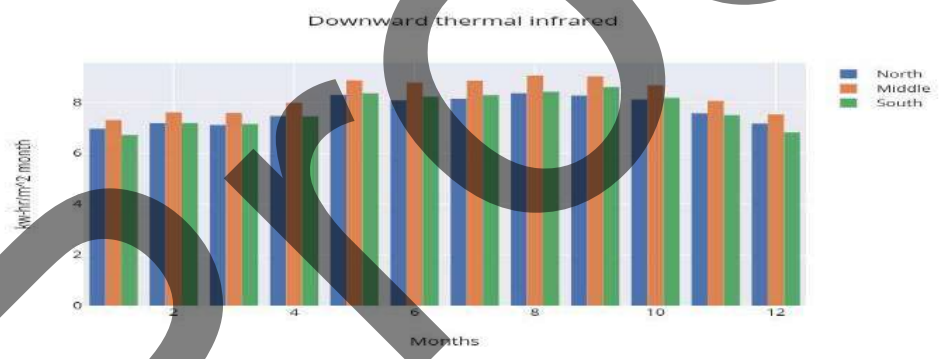

FIGURE 6: Monthly downward thermal infrared (longwave) irradiative flux average in (2018) in north middle and south

TABLE 8: irradiative flux Average (kW-hr/m^2 month

	north	Middle	South
minimum	6.95	7.29	6.71
maximum	8.35	9.05	8.58

As a result of comparing the minimum and the maximum downward thermal infrared (longwave), irradiative flux average per month the south has the smallest average value of the irradiation and the middle has the biggest value with a small difference.

All sky Insulation Incident on aHprizontal surface

All Sky Insolation Incident on a Horizontal Surface

Definition

- Solar irradiation Flowing average at morning hours towards a horizontal surface (m^2) on the earth from the sun at each day in all sky conditions.

- All Sky Insolation Incident on a Horizontal Surface Unit: kW-hr/m^2/day.

the minimum and the maximum values of the monthly all-sky insolation index on horizontal surface average in (2018) in north middle and south Jordan are shown in figure 7 and table 8.

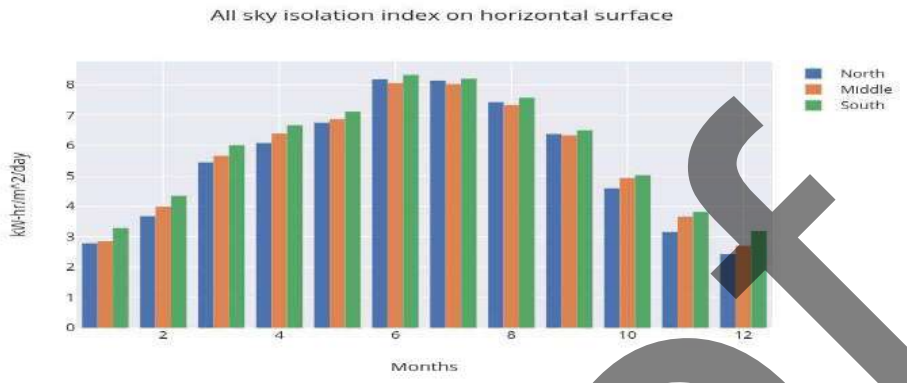

FIGURE 7. Monthly all-sky insolation index on horizontal surface average in (2018)

TABLE 9. All Sky Insolation Incident on a Horizontal Surface Unit: kW-hr/m^2/month.

	north	middle	south
Minimum	2.4	2.7	3.18
Maximum	8.2	8.06	8.33

As a result of comparing the minimum and the maximum values of all-sky insolation index on horizontal surface average per month, the north has the smallest average value of the Insolation Incident and the south has the biggest value.

INSOLATION CLEARNESS INDEX

Definition

- Solar radiation average reaching the Earth's surface divided by the amount of atmospheric insolation of the solar radiation.
- Insolation Clearness Index Unit: dimensionless.

The minimum and the maximum values of the Monthly insolation clearness index average in north middle and south Jordan are shown in figure 8 and table 8.

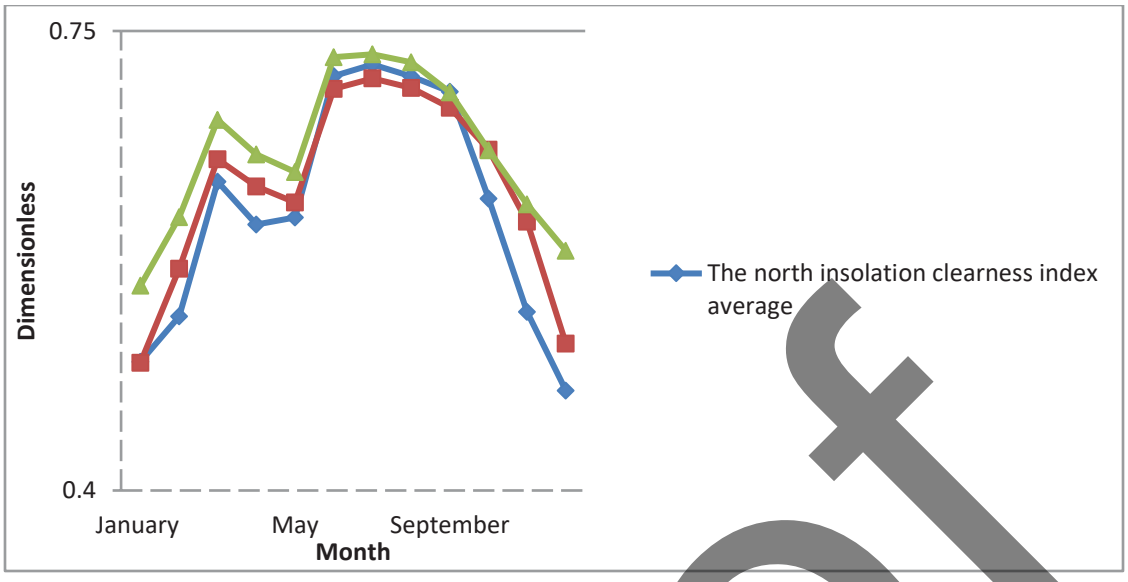

FIGURE 8: Monthly insolation clearness index

TABLE 10. minimum and maximum of the insolation clearness index average in Jordan

	north	middle	south
minimum	0.5	0.5	0.6
maximum	0.72	0.71	0.73

As a result of comparing the minimum and the maximum insolation clearness index per month the north has the smallest value and both the north and the south have the biggest value, but the difference is extremely small.

Middle Jordan has larger population comparing to the north and the south, which will for sure increase the carbon dioxide, so the middle is more polluted.

As you can see in figure 6 the middle has the highest Downward Thermal Infrared (Longwave) Irradiative Flux, although it has the lowest irradiant and clearness.

So, you can see that global warming has an effect on the irradiation values so it effects on PV system production.

CONCLUSION

The real optimum angle of panels is different with the optimum angle according to latitude. The best performance of three technologies of panels is (Mono-type) which it was achieved high efficiency with comparing it with others types at the same condition. In north of Jordan the best angle is 15◦, in middle of Jordan the best angle is 10◦, and in south of Jordan the best angle is 19◦.Maan achieves the best performance of the best technology, which the mono technology has high efficiency with extra power percentage. The bad choice of tilt angle reduces the efficiency of panels even though its giving more than its nominal value of watt peak when select the correct tilt angle as we note in our studying cases.

The optimum performance of PV technologies achieves many benefits of which energy saving, carbon dioxide reduction.

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Application of Machine Learning in Malware Detection for Android

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ABSTRACT. The fight to reduce Android malware has been seen as an important endeavour as the use of smart devices powered by the Android operating system grows in popularity complex evasive methods that require more effort modern methods of detection. Consequently, in this article, two Support Vector Machine (SVM) techniques for Machine Learning (ML) K-Nearest neighbours (KNN) and Support Vector Machine (SVM) are used and assessed to carry out the feature set's categorization into applications (apps), whether good or bad, via guided education procedure. Static app analysis is part of this study. which examines if keywords are present and used often in the static feature sets are derived from the Android applications' manifest file. a collection of 400 apps will help detect malware more accurately. The experimental findings show that employing SVM and KNN, the average accuracy rates for a dataset of genuine malware and benign applications are 88.66 percent and 80.33 percent, respectively, with average true positive rates of over 70.0 percent and 79.66 percent.

INTRODUCTION

One of the most popular operating systems for smartphones, tablets, and other devices has been recognised as Android. Android is susceptible to virus assaults, much like any other system, which hackers employ to steal sensitive data. As a result, the majority of hackers target Android, A subfield of AI and computer science called machine learning focuses on using data and algorithms to simulate how people learn, progressively increasing the accuracy of the system, Machine learning is significant because it aids in the creation of new goods and provides businesses with a picture of trends in consumer behaviour and operational business patterns. A significant portion of the operations of many of today's top businesses, like Facebook, Google, and Uber, revolve around machine learning, so one of the necessities in this industry is to safeguard android smart-phone from abuse or any dangerous applications. Antivirus programmes are used to stop and identify such assaults in order to safeguard Android systems. However, currently available commercial solutions can only stop and identify malware that is already known to them, thus newly created malware may still go undiscovered for months or even years. Researchers have suggested using Machine Learning (ML) techniques in Android malware detection systems to detect malware using behaviour-based, change-based, and anomaly-based software to address this issue [1].

Machine learning has been widely utilised to identify and categorise a variety of Android applications. A learning classifier is basically trained using feature vectors that describe the syntactic or semantic aspects of the applications on a labelled collection of sample data. The structure of Android applications appsgives significant syntactic information such as, methodand package names, permissions, and configuration files. As a result, statically generated characteristics enable the detection and categorization of various Android applications. This work uses the two most promising ML classifier methods picked from prior research, namely the Support Vector Machine (SVM) and K-Nearest Neighbour (KNN) algorithms, to assess both the user permissions and intent filters requested in an Android app's manifest file[2].The primary goal of this study is to determine whether examining keywords in both the permissions sought in an app's manifest file and system call logs may help us detect malware applications more effectively when utilising the two ML techniques discussed above.The rest of this essay is structured as follows. An overview of the current research on Android malware detection using ML algorithms is provided in Section 2 by various researchers. The methods we used to conduct this research is described in detail in Section 3, while Section 4 presents the findings and a commentary. Finally, Section 5 summarises our findings and presents potential.

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TABLE 1. Classification of SVM & KNN Model**.**

Algorithm	Benefits	Drawback
K-Nearest Neighbors (KNN)	KNN is a simple to learn, Quick to train, and immune to noisy data method.	Restricted memory
Support Vector Machine (SVM)	Robust to noise and over fitting, specifically well-liked in non-linear difficulties	SVM is a computationally expensive, slowdown the process.

RELATED-WORK

A significant amount of effort has been put into developing several machine learning-based systems for Android malware anomaly detection in recent years. The three primary categories of these methods are static, dynamic, and hybrid malware analysis. Kumaran and Li are two researchers that use static analysis. Due to the relatively low importance of the intent filters alone, their choice of ML algorithms first evaluates both the intent filters and permissions sought in an app's manifest.xml file separately, which substantially increased the disparity in detection accuracy [3],[4] and [5]. However, combining the two static feature sets yielded results for detection accuracy of 91.7 percent (SVM) and 91.4 percent (KNN), which is an increase above the classification performance of the two separate feature sets. Due to their resistance to code obfuscation, frequent application updates, and the open-source nature of Android, which allows for increasing exposure of device characteristics, dynamic analysis has received the majority of attention in research on Android malware detection. According to Singh and Hofmann [10], applying an SVM classifier with correlation analysis to system call behaviours produced the greatest results in terms of dynamic analysis, with 97.16 percent accuracy and 99.54 percent recall. They maintain that system calls are appropriate characteristics for malware detection since they call the Linux kernel to allocate all device resources to programmes. In their work, they also discussed their observations on system call habits pertinent to malware detection [6]. Tan et al. examine Android API requests using a mix of feature weightage, feature correlation, and the Nave Bayes ML classification model. The suggested model obtains a result of 0.6678 for recall and 0.6894 for precision when compared to their Naive Bayes classification model result (recall rate 0.3255, precision rate 0.4266). To achieve high classification accuracy, obfuscation robustness, and system scalability, Garcia et al concentrate on monitoring Android API use and system calls by native binaries. A 98 percent measure for detection and an 84 percent malware family categorization rate are achieved by their suggested method. The identification of malicious software using anomalies is a key component of Al Ali et al study's [7]. The Waikato Environment for Knowledge Analysis (Weka) operating on a remote server is used by their proposed framework to extract feature vectors from system metrics (such as battery or network statistics) and subsequently classify them. This preserves device resources. Random Forest (RF), SVM, and Nave Bayes were the top 3 algorithms that outperformed the competition. Their SVM approach (Sequential Minimal Optimization, SMO, utilising the PUK kernel) comes in second with results that are almost identical to those of the RF algorithm, while the RF algorithm delivers the greatest true positive rate, accuracy, recall, F-measure, and AUROC (all greater than 0.9). Their KNN approach (Instance Based Learner, IBK , with k = 10 neighbours) outperforms SVM in terms of accuracy and recall, but it generates an equal number of false positives as RF. The SVM and KNN algorithms therefore need more research to ascertain their application. Last but not least, with regards to hybrid analysis, Rehmanet al suggested that a keyword-based analysis on both the constant strings (binaries) and the AndroidManifest.xml files of an Android app might help in more successfully identifying malicious apps. SVM provided the best classification performance for constant string analysis, and KNN provided the best classification performance for manifest file analysis. KNN impressively achieved a 99.81 percent accuracy and a 0.38 percent false positive rate when evaluating both malicious manifests and constant strings in the same feature vector. Their article contains a list of pertinent permission requests that should be taken into account[8] and [9]. Their findings imply that, in contrast to classification only based on either static or dynamic characteristics, a feature vector composed of both a program's manifest declarations and certain observable behaviours of said app will increase malware detection sensitivity has shown that Android OS system call logs generated by apps are accurate predictors of possible malware, while have shown the value of permissions and intent filters specified in the manifest.xml file to accomplish the same

goal. We thus postulate that a combined examination of both feature sets, as opposed to only static or dynamic feature sets, increases the accuracy of Android malware detection. Additionally, the literature makes frequent reference of the ability of SVM and KNN ML classifier algorithms in carrying out Android malware detection. As a result, we also want to evaluate and contrast how well these two ML algorithms perform in the hypothesis situation. In that sense, our initial presumption is that the accuracy and true positive metrics of the two ML systems do not differ noticeably.

RESEARCH METHODOLOY

The goal of this study is to investigate if examining keywords in the system call logs generated by an Android app as well as the permissions sought in the app's manifest file may produce better results than individual feature analysis. The other goal is to compare and assess the performance of SVM and KNN algorithms in identifying malware, as both algorithms have been shown in prior study to be successful ones because of the high detection accuracy they offer. We used the M0Droid dataset, which includes 200 safe applications and 200 malicious apps[10]. Three feature vectors were created from the dataset by preparing and processing it in accordance with the subsequent subsections. These feature vectors include a combination of both dynamic (system call logs only) and static (manifest keywords only) feature sets. Comma-separated value (CSV) files were created using string manipulation scripts, one CSV record per app, and they include the integer number of times each feature occurs in an app's manifest and/or runtime behaviour. In TABLE 2, The Classification of Static, Dynamic & Hybrid analysis.

TABLE 2. Classification of Static, Dynamic & Hybrid analysis.

Aspects	Static Analysis	Dynamic analysis	Hybrid analysis
Based on	Code analysis and research	Malware activation	The data collected from static analysis, an analyst can undertake dynamic analysis more effectively.
Necessary time	Minimal	Maximal	Maximal
Sources	Minimal	Maximal	Maximal
Directly impacted by Obfuscation, packing, etc	True	False	False
Drawback	Some malware forms might be difficult to identify, placing a heavy reliance on malware analysts' expertise as drawbacks.	Laboratory preparation is required. high time and requirements that are needed	High expense, specifically in terms of time
Benefits	Minimal costs involved and time	High rate of detection is a benefit provide facts regarding virus activities	The combined information from the analyses leads to more accurate results.
Performance	Lesser powerful than dynamic analysis	Medium	High performance combines both forms of analyses to increase the accuracy of the outcomes and reduces overall method drawback

STATIC ANALYSIS

A malware file is examined using static analysis without the programme being launched. This method of malware analysis is the most secure since running the code might infect your machine. Static analysis, in its most basic version, gathers data from malware without even looking at the code. Static analysis, often known as static code analysis, is a technique for troubleshooting computer programmes that involves looking at the code without actually running the programme. The procedure gives insight into the organisation of the code and can assist guarantee that it complies with best practises. The 400 Android package (APK) files of the dataset were first decompiled using the APKTool in order to compile the static feature vector. Next, a Windows PowerShell script was written to extract the decompiled AndroidManifest.xml file from all of the dataset apps and isolate them into a separate folder [11]. The next step was to create a Python script to examine each manifest, searching for particular phrases that were known to indicate the potential presence of malware and logging the frequency with which each term occurred in the manifest. The list of pertinent manifest terms is taken from TABLE 3: Relevant manifest keywords, with certain keywords that do not appear in any manifests in our dataset being disregarded.

TABLE 3. Relevant manifest keywords.

Mainfest.xml element	Keyword
Permissions	READ_SMS, SEND_SMS, RECEIVE_SMS, WRITE_SMS, PROCESS_OUTGOING_CALLS, READ_HISTORY_BOOKMARKS, WRITE_HISTORY_BOOKMARKS, READ_LOGS, INSTALL_PACKAGES, MODIFY_PHONE_STATE.
Intent Filters (Action)	BOOT_COMPLETED, SMS_RECEVED, CONNECTIVITY_CHANGE, NEW_OUTGOING_CALL, UNINSTALL_SHORTCUT, INSTALL_SHORTCUT, VIEW, MAIN, CALL.
Intent Filters (Category)	HOME, BROWSABLE, LAUNCHER
Intent Filters (Scheme)	SMS, FILE, CONTENT
Intent Filters (Priority)	1000, 999, 2147483647, 100
Receivers	On boot receiver, Auto Run Broadcast Receiver, SMS Receiver, Security Receiver, Repeating Alarm Service, Ad Notification, GCM Broadcast Receiver, Message Receiver, Action Receiver.

DYNAMIC ANALYSIS

Dynamic analysis involves exploding a suspect file in a virtual computer, like a malware analysis environment, and then examining it to discover what it does. In a secure setting known as a sandbox, dynamic malware analysis runs suspected dangerous code. Due to the closed system, security experts may observe the virus in operation without worrying that it would compromise their system or get access to the company network. System log files from the dataset applications were gathered in order to assemble the dynamic vector. The apps were each ran individually in virtual computers that had the Android operating system preinstalled. Two new programmes were added to the environment to extract the logs from the dataset files. In order to track the logs of one programme over time, "Log-cat Extreme" was used to preserve the log files of running applications. The programme was launched using "ES File Explorer [12]." After extracting the logs, malware programmes were individually deployed and removed. The log files

were then removed from the virtual system and placed in the "Malware" and "Goodware" folders, respectively explained in TABLE 4: Relevant system calls.

TABLE 4. Relevant system calls.

.System call	Description
Read	Read data from files/device
Write	Write data to device/files
Open	Open file
Close	Close file
Unlink	Delete files
Chmode	Change permission
Lseek	Change location of read/write pointer
Getpid	Get process identifier
Access	Check access to a file
Rename	Rename a file
Dup	Creates copy of file descriptor
Brk	Change the location of program break
Uname	returns system information
Mprotect	set protection on a region of memory
Stat64	get file status
Madvise	give advice about use of memory

HYBRIDS ANALYSIS

In order to overcome the weaknesses of each methodology, hybrid analysis uses approaches from both. When unpacking the binary files or reading them in assembly code, some operations that might be masked at run-time might be seen. The list of features for the combined feature vector was expanded as a result of appending the CSV files for the static and dynamic feature vectors to one another. Only the dataset applications that had been successfully pre-processed in both the static and dynamic analyses were included in the combined feature vector. A custom script was used to associate and attach the static and dynamic features for each app under consideration.The feature vectors in the CSV files were then transformed into Attribute-Relation File Format (ARFF) files, which were then imported into the Weka Explorer for classification. The elements of the ARFF feature vector were divided into malware and goodware using the Weka versions of the SVM and KNN algorithms, SMO and IBK, respectively [13]. The dataset was divided into several (content-wise) but equally-sized subgroups of goodware and malware before all the ML classifications were carried out with 10-fold cross validation applied to the feature vector. The purpose of cross validation is to properly assess the generalizability of the trained algorithm towards identifying malware from unidentified programmes while reducing the likelihood of overfitting during algorithm training. Multiple classification rounds of the same feature vector were conducted using the SMO (SVM) and IBK (KNN) algorithms, using the setup parameters (complexity c and kernel for SMO, the distance metric for IBK) and neighbour count k) varied at each round.

In malware Detection we used algorithms [SVM and KNN], in which we had given the data set to the model and then, they predict from it. In first Parameter if, C=1 Which is default and constant value. The prediction was up to 4 kernel and normalised (c) = 4 and from the SVM we got the accuracy 85% above and on the other hand in second Parameter if C=1 which is default and contact value of nearest.

The prediction was up to 5 Euclidean distance and Manhattan (k)= 5 and from KNN we got the accuracy 88% above. Each round's final results summary listing the different evaluations of the ML algorithm's effectiveness at spotting malware according to the specified algorithm setup, from the feature vector the best and worst outcomes of all the tests were noted in TABLE 5: ML configurations.

TABLE 5. Relevant system calls.

ML Algorithm	Parameters	Label
SVM	C=1, default value	SMO1
	Kernel C=4	SMO2
	Normalized, C=4	SMO3
KNN	K=1 default Value	IBK1
	Euclidean Distance K=5	IBK2
	Manhattan, K=5	IBK3

An algorithm used in malware detection explained by the following flow chart.

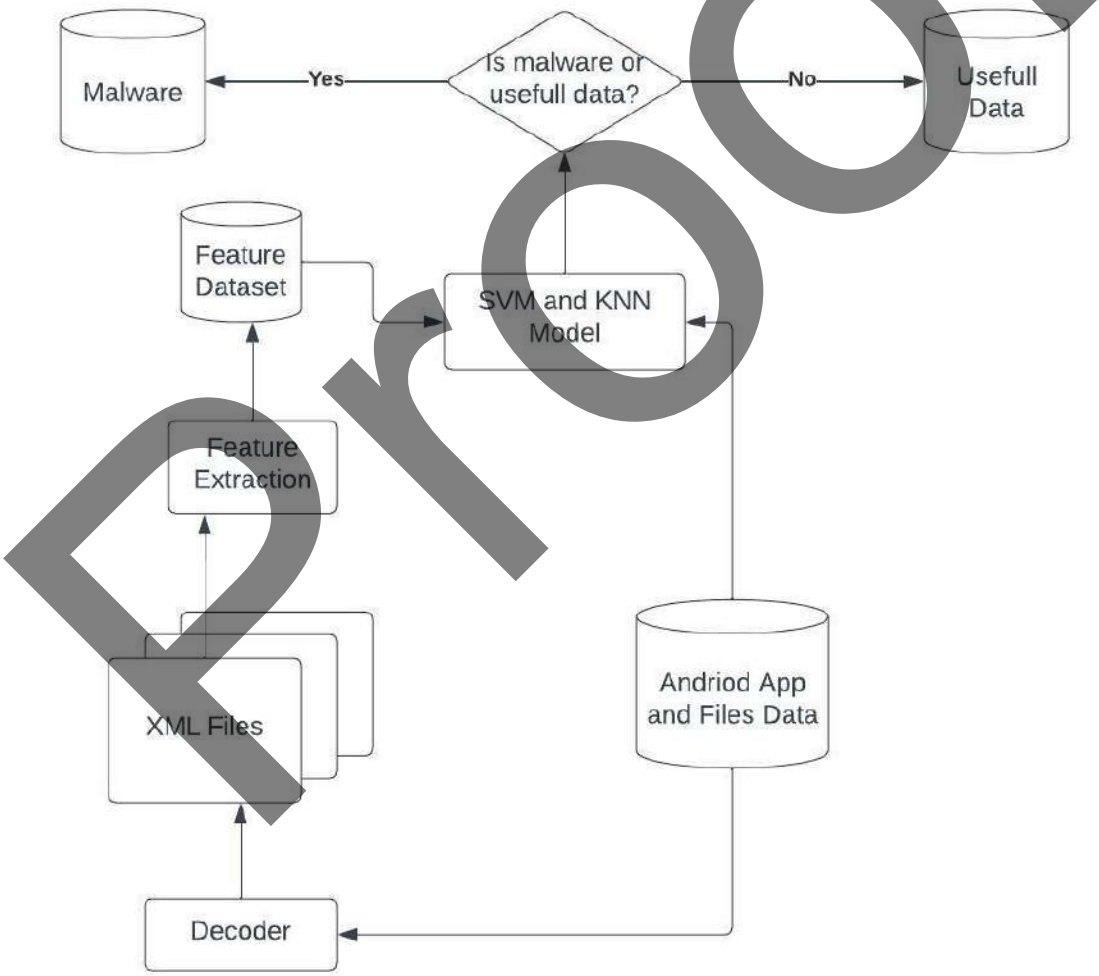

FIGURE 1. Flow Chart.

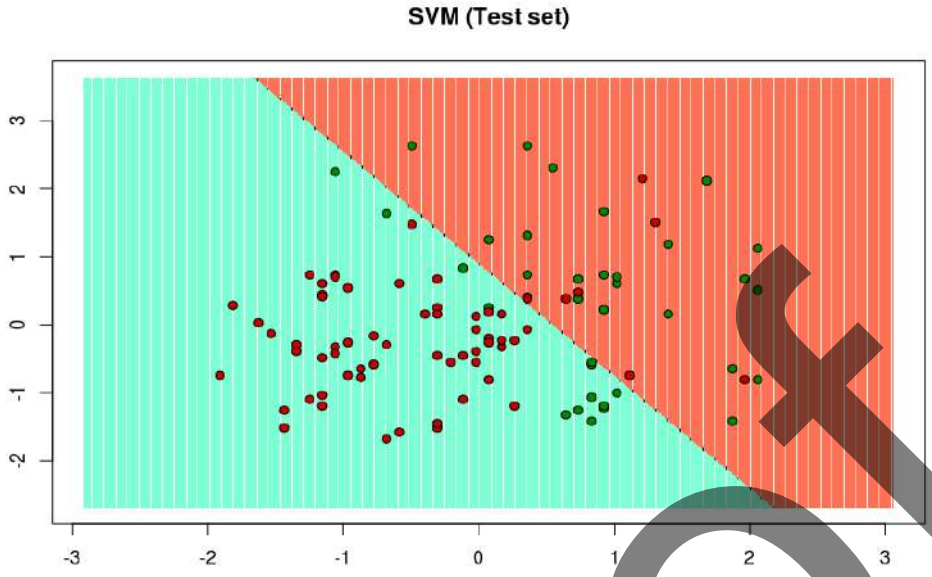

FIGURE 2. SVM Classification Result with Testing Dataset.

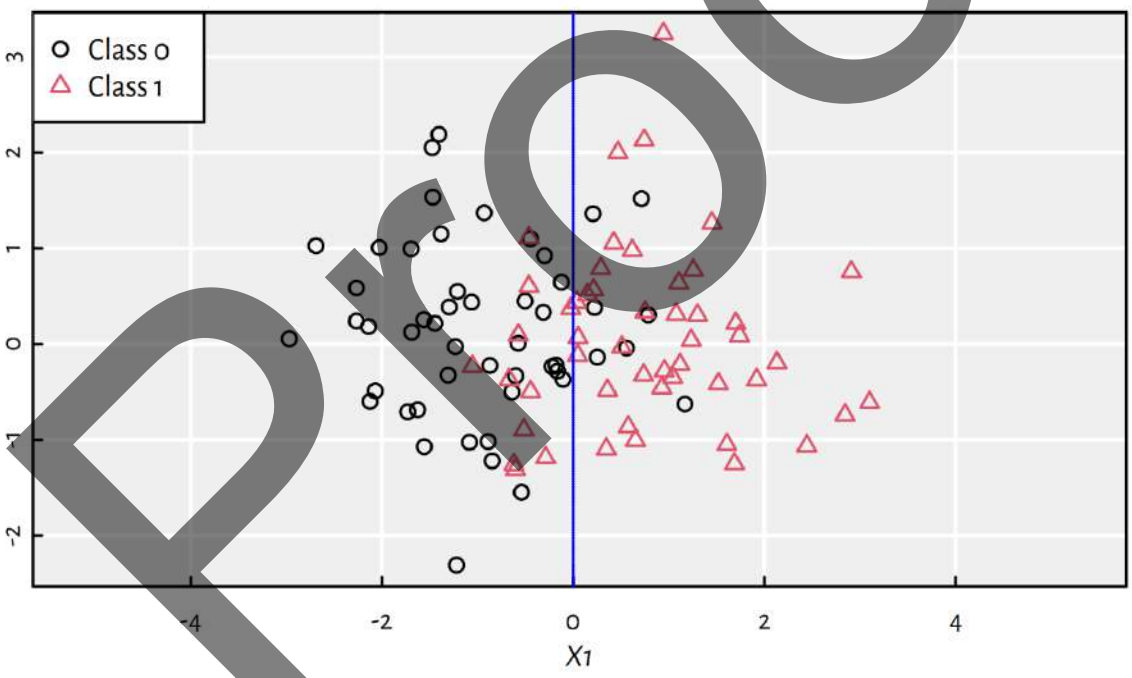

FIGURE 3. KNN Classification Result with Testing Dataset.

RESULT AND CONVERSATION

The static feature vector derived from the dataset may be assembled without the need for a specific malware testing environment hence a static ML analysis of the app manifest keywords was carried out as a first test of the suggested technique. In this article, it was suggested that feature vector preparation for dynamic analysis and hybrid analysis be done in further studies. This is because in order to correctly log and extract system call sequences while running the applications with full rights and functionality for total app coverage in a controlled environment, specialist scripts and emulation tools are needed. The findings of the static analysis show that neither the SVM nor the KNN (IBK) algorithms significantly vary in their ability to recognise objects. However, the detection accuracy just indicates that

over 80% of benign or malicious applications are properly predicted by static analysis alone and makes no distinction between false positives and false negatives. However, the malware true positive rates give a more accurate picture of how well the two ML systems work. In Table 5, it is demonstrated that KNN (IBK) outperforms SVM in terms of the proportion of evaluated apps where malware was effectively identified by the algorithm. Despite this, both ML algorithms continue to have identical detection accuracies.This means that as a cost of recognising malware more thoroughly, the KNN algorithm produces more false positives (harmless software tagged as malware). Overall, there is not much of a difference in the detection performances of SVM and KNN algorithms in terms of accuracy and true positive rate when the manifest keywords of applications are taken into account as features. However, after dynamic and hybrid feature analyses are carried out in TABLE 6**:** Static(manifest) vector classification results.

TABLE 6: Static (manifest) vector classification results.

ML Algorithm	Accuracy %	True Point%	YES/NO
SMO1	89.75%	69%	Yes
SMO2	89.72%	69%	No
SMO3	88.91%	72%	Yes
IBK1	84.00%	79%	No
IBK2	79.00%	80%	Yes
IBK3	78.53%	80%	Yes

The findings of the static analysis show that neither the SVM (SMO) nor the KNN (IBK) algorithms significantly vary in their ability to recognise objects. However, the detection accuracy just indicates that over 80% of benign or malicious applications are properly predicted by static analysis alone and makes no distinction between false positives and false negatives [14] and [15].

However, the malware true positive rates give a more accurate picture of how well the two ML systems work. In Table 5, it is demonstrated that KNN (IBK) outperforms SVM (SMO) in terms of the proportion of evaluated apps where malware was effectively identified by the algorithm. Despite this, both ML algorithms continue to have identical detection accuracies.This means that as a cost of recognising malware more thoroughly, the KNN (IBK) algorithm produces more false positives (harmless software tagged as malware). Overall, there is not much of a difference in the detection performances of SVM and KNN algorithms in terms of accuracy and true positive rate when the manifest keywords of applications are taken into account as features. However, after dynamic and hybrid feature analyses are carried out, this hypothesis may or may not hold true.

CONCLUSION

To test if keyword analysis might produce more accurate results than individual feature analysis, we employed keywords as the main malware detection features in this research. Keyword analysis was done in both the system call logs and the permissions sought in an app's manifest file. To categorise Android applications as either benign or malicious, we used and compared two machine learning algorithms named SVM and KNN. Based on calculating the accuracy and true positive rates of Android malware detection, 35 findings were evaluated. According to our findings, SVM and KNN, respectively, have accuracy rates of 79.08 and 80.50 percent and true positive rates of 67.0 and 80.00 percent. In a follow-up study, it would be interesting to broaden our technique by taking into account two kinds of dynamic and hybrid malware analysis and comparing the outcomes with those from this study. Investigating the use of unsupervised learning methods on the same or a different dataset in order to detect Android malware is yet another intriguing research area.

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Mathematical Model of the Spread of COVID-19 Using Any Logic System

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Abstract. The new coronavirus that is the source of the pandemic respiratory infection known as COVID-19 poses a major risk to the public's health. In this paper, we present a mathematical model of the spread of an infectious disease according to the characteristics of the COVID-19 pandemic. The proposed improvedmodel is developed on the AnyLogic system, which will be referred to as the SEAIR (Susceptible-Exposed-Asymptomatically Infected-Symptomatically infected-Recovered) model. The paper considers mathematical models that are used to analyze and predict the development of the COVID-19 pandemic, including time series analysis, equations of mathematical physics and simulation models, their various combinations and generalizations. Due to the novelty and complexity of the COVID-19 disease, the parameters of most mathematical models are usually unknown, and this leads to the need to consider and solve inverse problems.

INTRODUCTION

The vast virus family known as coronaviruses is known to cause illnesses ranging from the common cold to more serious conditions like severe acute respiratory syndrome (SARS). In a cluster of pneumonia cases in Wuhan, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was shown to be the culprit [1]. Then it spread to other parts of China and the world, creating a global health emergency. The World Health Organization (WHO) declared the illness coronavirus disease 2019 (COVID-19) a global pandemic in February 2020 [2]. The coronavirus outbreak has demonstrated that the human race is not prepared for the significant difficulties brought on by the spread of epidemics. In both rich and poor countries, the economy, the health system, and administrative and managerial organizations have not been able to control the spread of a disease that is not the most serious.

Coronavirus disease 2019 (COVID-19) is caused by SARS-CoV-2 with typical symptoms of dry cough, fever, and tiredness [3-5]. Pharyngeal swabs, sputum, alveolar lavage fluid, feces, and other patient samples have frequently been used in nucleic acid detection and genome sequencing to identify SARS-CoV-2 [6–10].According to reports, COVID-19 can spread from person to person, with the two major modes of transmission being contact and the air [11–15].

In addition to researching the mathematical capabilities and properties of models, mathematical modeling of epidemics spreading among humans has a long history. Specific epidemics have been simulated and their evolution has been controlled [16-20]. Since the first outbreak in China, mathematical modeling of the COVID-19 epidemic's propagation in other nations and regions of the world has been conducted extensively. Coplanar models with constant parameters cannot be used to predict the spread of the COVID-19 outbreak[21].

Currently, the task is to predict the size of potential social damage, the timing of the epidemic's peak and end, as well as the efficacy of potential management decisions, aimed at preventing the epidemic's spread. This is due to the epidemic caused by the spread of the SARSCov-2 coronavirus (COVID-19) and the de facto biological and social emergency that has begun.

In this situation, mathematical models that describe these processes can be useful. Additionally, there are a number of methods for simulating the spread of the epidemic that may be used to compare various development trajectories and analyze current processes in relation to management decisions.

The goal of this study was to create a modified compartmental mathematical model for the prediction of COVID-19 epidemic dynamics while taking into account various intervention scenarios, which could provide information about the most effective actions to lower the probability of an epidemic. The suitability of the starting parameters that must be supplied to the model's input determines, among other things, the accuracy of the findings obtained when applying the established model of the epidemic's spread. It is important to assess the findings of research conducted by virologists or medical professionals since some metrics have special regional features (which may rely, for example, on population density) and others are exclusive to a particular virus.

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DESCRIPTION OF THE MODEL

A major assumption of many mathematical models of epidemics is that the population can be divided into a set of distinct compartments. These compartments are defined with respect to disease status. The simplest model, which was described by Kermack and McKendrick in 1927 [22], consists of three compartments: susceptible (S), infected (I), recovered (R).In general, the SIR model can allow, at least in the first approximation, to estimate the approximate dynamics of the spread of the epidemic. But the real process of the course of diseases is somewhat more complicated, it is necessary to take into account a number of factors when modeling. First of all, this concerns the fact that the disease process can consist of at least two stages: the incubation period (without external signs of the disease) and the disease period itself (with the presence of external signs of the disease and the possible isolation of the infected individual).

In the study, a mathematical model of the spread and transmission of SARS-CoV-2 was formulated. We consider two interacting populations, the human population as hosts and the pathogens. The model subdivides the total human population size at time t denoted as N(t) into susceptible S(t), exposed E(t), asymptomatic infectious $I_A(t)$, symptomatic infectious $I_S(t)$ and the recovered as R(t). Hence for the human population we have $N(t)=S(t)+E(t)+IA(t)+IS(t)+R(t)$.

According to studies, the virus can spread from person to person and from the environment to person. According to the epidemic data, COVID-19 virus transmission to susceptible individuals S (t) in close contact with infected individuals I_A (t) and I_S (t) is possible. Additionally, the virus spreads to the environment when sick people sneeze or cough without taking the proper precautions.

Given that the virus can live in the environment for a few days, susceptible persons S (t) who are in close contact with this environment are likely to be exposed to these infections, especially in the early stages of the COVID-19 outbreak before hygiene standards are put in place. In the process of disease spread, the susceptible individual first moves to the exposed population E (t) since the host has an incubation period [23]. The exposed individual moves to either asymptomatic $I_A(t)$ or symptomatic $I_S(t)$ infectious population. The majority of infectious individuals recovers and moves to the recovered human population R(t).

The compartmental model depicting the interaction between the human populations in the environment is shown in Figure 1.

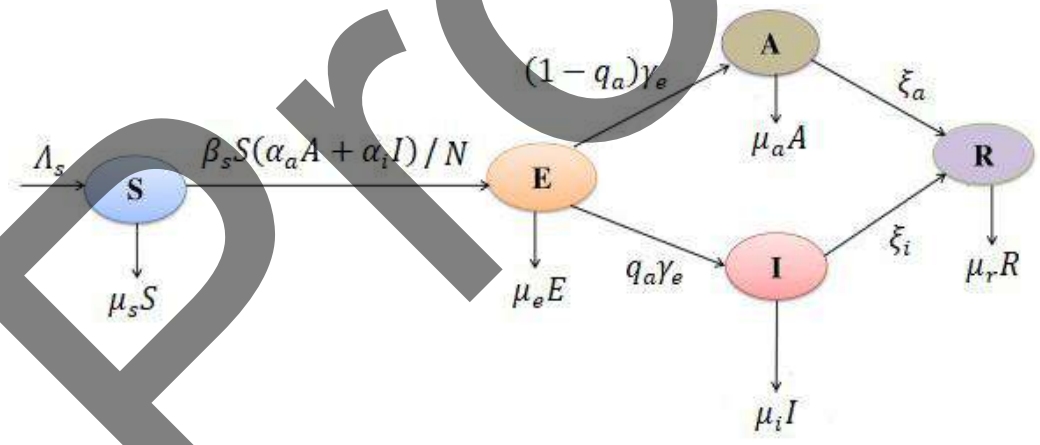

FIGURE 1.SEAIR model of COVID-19 transmission.

The schematic flow diagram represents the biological mechanism of the novel coronavirus (COVID-19) infection in Jordan, which influences the formulation of the mathematical model. The mathematical model consists of five sub-populations: susceptible S (t), exposed E (t), asymptomatic A (t), symptomatic or clinically ill I (t) and recovered R (t) individuals in a total population of N (t) = S (t) + E (t) + A (t) + I (t) + R (t) individuals. $\Lambda=n\times N$. N is the total number of individuals and n is the birth rate.

The model culminates to a five-dimensional system of ordinary differential equations as follows:

$$\begin{cases} \dfrac{dS}{dt} = \wedge_s - \dfrac{\beta_s S(\alpha_a A + \alpha_i I)}{N} - \mu_s S \\ \dfrac{dE}{dt} = \dfrac{\beta_s S(\alpha_a A + \alpha_i I)}{N} - \gamma_e - \mu_e E \\ \dfrac{dA}{dt} = (1-q_a)\gamma_e E - \xi_a A - \mu_a A \\ \dfrac{dI}{dt} = q_a \gamma_e E - \xi_i I - \mu_i I \\ \dfrac{dR}{dt} = \xi_a A + \xi_i I - \mu_r R \end{cases} \quad (1)$$

The parameters used in the COVID-19 transmission model are given in Table 1.

TABLE 1. Description of model parameters.

Parameter	Biological Meaning	Values
$\wedge_s$	Inflow Rate of Susceptible Individual	----
β_s	Disease Transmission Coefficient	day $^{-1}$
α_a	Adjustment Factor For Asymptomatic Classes	0.5
α_i	Adjustment Factor For Symptomatic Classes	0.7
μ	Natural Death Rate For All the Individuals	0.05 day $^{-1}$
γ_e	Conversion Rate From Exposed to Asymptomatic Individuals	0.3 day $^{-1}$
q_a	Proportion of Exposed Individuals	0.075
ξ_a	Rate of Recovery from Asymptomatic Individuals	day $^{-1}$
ξ_i	Rate of Recovery from Symptomatic Individuals	day $^{-1}$

SIMULATION MODEL USING PACKAGE ANYLOGIC

The proposed simulation model was developed in the Any Logic environment [24]. Any Logic supports the development and modeling of feedback systems (flow and accumulator diagrams, decision rules, including arrays of variables). The model developed in the Any Logic environment is designed to study the characteristics of an epidemic and the system recovery process. The environment allows you to change the values of the model parameters directly during its operation, which in real life is similar to human intervention in various processes.

At realization the model using computer graphics simulation Any Logic program [25, 26] transition graph simulation model of COVID-19 as shown in figure 2.

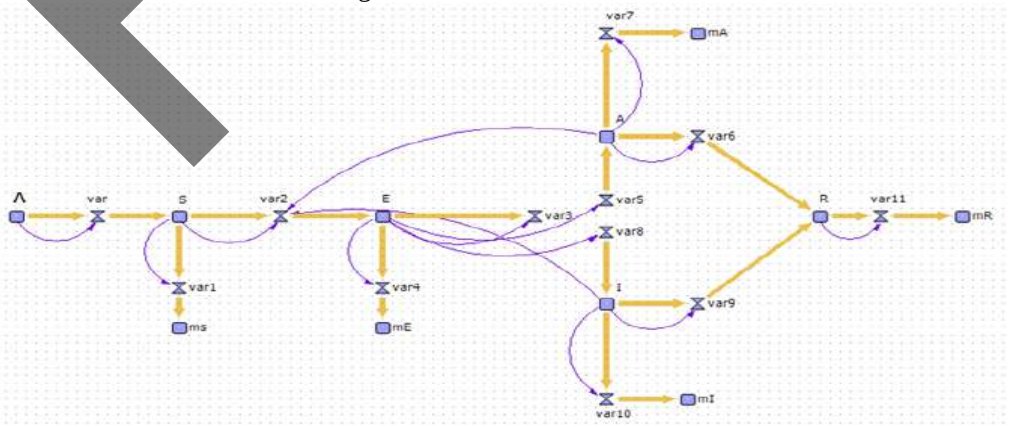

FIGURE 2. Simulation model using package AnyLogic.

Input and output parameters of the model are shown in table 2

TABLE 2. The main parameters included in this model

Symbol	Adopted Text Designation
var	$n \times N$
var1	$\mu_s S$
var2	$\beta_s S(\alpha_a A + \alpha_i I)$
var3	$\gamma_e E$
var4	$\mu_e E$
var5	$(1-q_a)\gamma_e E$
var6	$\xi_a A$
var7	$\mu_a A$
var8	$q_a \gamma_e E$
var9	$\xi_i I$
var10	$\mu_i I$
var11	$\mu_r R$

RESULT

In this section, we approximate solutions to the model equations (1) which are implemented via the function in Any Logic. The initial values used are S(0) = 10000, E(0) = 50, $I_A(0)$ = 10, I_S (0) = 10, R(0) = 0. Figure 3a shows the population change from 0 to 30 days in relation to time. In the first two days, as more people become exposed due to contact with sick people (I_A and I_S) and the virus in the environment, the number of vulnerable persons rapidly declines.

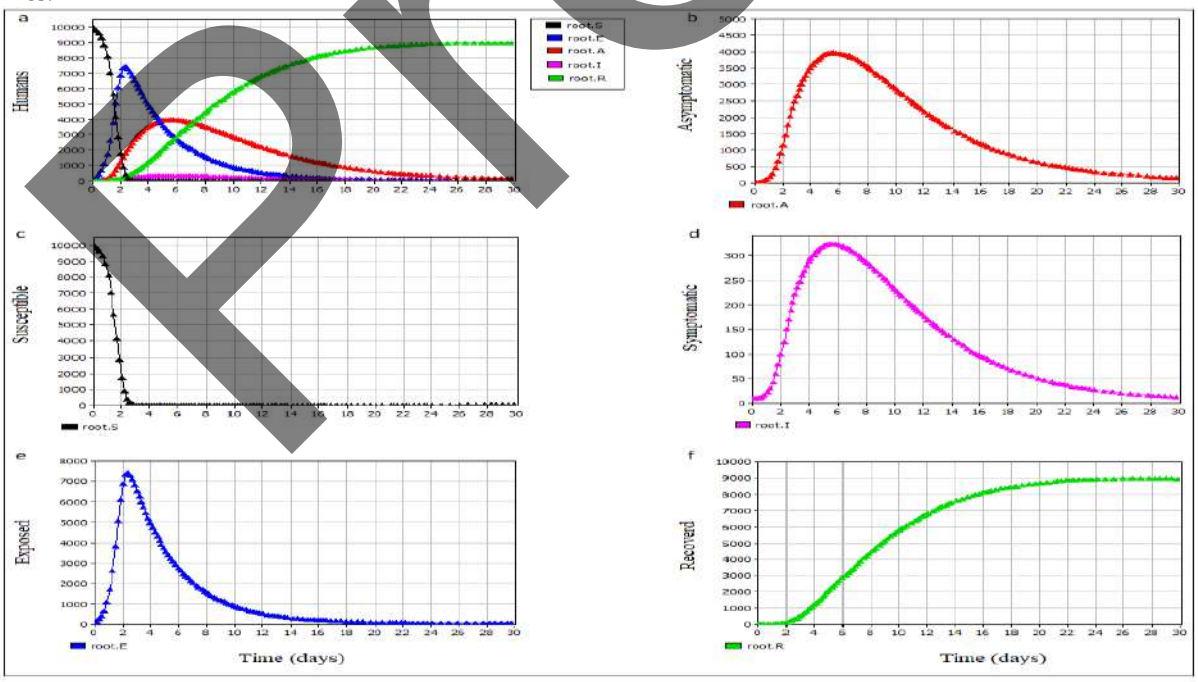

FIGURE 3. The simulated humans populations are shown in (a) respectively. Effects of the factors α_1 and $\alpha_2$which determines the rates of new infections are shown in (b-f).

Table 1 displays the model parameters used in this simulation investigation. Since the asymptomatic individuals I_A are thought to be more contagious than the symptomatic individuals I_S, the risk of COVID-19 transmission through contacts in homes, workplaces, and schools as well as through food or during travel increases. In this model, we assume that factors α_1 and α_2 are, respectively, the inverses of the frequency with which an individual picks up the COVID-19 from the environment and from an infected person.

In Figure 3 the model demonstrates that when the change in adjustment factors for individuals, thenumber of exposed, asymptomatic and symptomatic, individuals increases (see Figure 3b, d, and e for duration 0–6 days). As a result, with very few new infections, the number of infected people decreases after the eighth day, when the number of infected people is perceived to be reduced.

CONCLUSION

The model demonstrates that in order to prevent a significant COVID-19 outbreak, control measures such social isolation, mask use in public, frequent hand washing, and limiting non-essential travel are required. Since many features of the COVID-19 are still unknown, there is rising concern that the disease will continue to decimate the human population worldwide. This provides a problem for long-term mathematical modeling of the disease.

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The Impact of Shopping Malls on Jordanian Traditional Retailers: A Case Study of Amman Downtown

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Abstract. Shopping centers have become a notable place in the city in terms of architectural form and services and easy access. Shopping centers are the new lifestyle in modern cities, the entertainment gather services and trade in one compound, which works on reformulation region's nature, it offers an attractive service for citizens and accessibility, but nostalgia for the traditional markets including the originality and the spirit of the place still attracts people to experience. However, Amman city witnessed a significant shift in developers' and designers' attitudes about building malls which influenced the success of all traditional marketplaces and shopping habits. Proximity in time and location, as well as a lack of planning techniques, accelerated the growth of new malls, resulting in the degradation of street markets and traditional retile patterns in Amman city. Therefore, this study investigates the impact of the transition from the downtown shops to the shopping centers on the social life and Urban fabric as well as giving recommendations to reduce the negative impact of shopping centers on Amman city fabric. Results indicate that besides the site communities or districts, the growth of shopping malls on particular sites or places followed no plans, regulations, or restrictions. There were no studies or master plans that provided developers with suggestions or forecasts about how their malls will alter consumers' attitudes or behaviors, old markets or old malls, or the nearby or far urban vicinities and surroundings.

INTRODUCTION

In recent years, there has been a considerable decentralization of shopping space from large metropolitan centers to suburban communities. Until now, new organization of shopping space largely excluded the development of township areas. Marketplaces in urban Places used to attract a large number of buyers and sellers, as [1] mentioned in his writings that the presence of numerous shopping malls alongside traditional markets generates market congestion.

The main reasons, which forced to emerging markets into shopping malls, return to the narrowing if retail street and increasing the number of shopping mall [2]. The transformation of retail establishments has not been adequately planned for from both a marketing and customers' standpoint. As a result of urbanization, the high demand for secure and friendly malls or shopping centers is rapidly increasing [2], [3].

Large recreational shopping malls are widely noted that the majority of shoppers in developing cities choose to buy at suburbs complexes and power centers instead of downtown markets in order to attract repeat consumers and visitors to purchase regularly. [4]. Shopping centers are made more appealing by this location, which is described as providing comfort, excitement, variety, mall spirit, accessibility, and elegance. According to [5] who noted that Such mall appeal can be developed with three major types of shoppers in mind: consumers who are demanding, clamorous, and practical. This allows shopping mall administrators to establish convenient commerce methods to meet the needs of each segment.

This study will investigate how does the growing of shopping mall affects the urban area and shopping behavior, and investigates the impact of shopping center upon social life in Amman city. Moreover, the study will discuss the effect of these buildings on the urban pattern of Amman. The researchers investigated the effects of stimulation of the environment such as music, scent, and marking screens as essential determinants of attractiveness of shopping mall. Shopping malls, which located outside the city centers, have become increasingly important in recent years. Individuals who are involved with shopping field believe that such new shifts as a threat to the established trade in the cities.

LITERATURE REVIEW

A Great number of literatures and records defines shopping malls. Shopping centers are described by the International Council of Shopping Centers in the United States of America as "an enclosure, climatic-controlled as

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well as lit [shopping Centre], bordered on either one or both sides of pathways by stores, [anchors] and Entrances." Surface or structure-based on-site parking is often offered all around Center's boundary [6].

According to [6], A shopping center is "[a] cluster of retail as well as other commercial entities that are designed, constructed, controlled, and managed as a single property, with on-site parking supplied," as opposed to a mall, which refers to a different concept. The market features of the business region covered by the center often define the center's size and direction [7].

A shopping mall, shopping Centre, shopping arcade, shopping precinct, or simply mall is a complex of shops representing merchandisers with interconnecting Walkways allowing visitors to easily move from unit to unit, as well as a parking lot. The traditional marketplace has been modernized and moved indoors [7].

TYPES OF SHOPPING CENTERS

Shopping centers is categorized into two types. Type I consists of shopping malls with a variety of stores (for food, clothes, warehouse equipment, fragrance, drug stores etc.). As a result, there are numerous restaurants, cafés, and entertainment facilities [7], [8]. Many of Famous names in the field of fashion, accessories, footwear, and fragrance, as well as international and local companies, are represented here. Therefore, in this type of malls, the type of shopping here is more general focusing on food and clothes and eating. Some of other shopping malls lack eateries and cafés. Shopping malls that are only for shopping are classified as Type II [8], [9]. The center is typically a big-box store or department store, which is a large store or store that sells a variety of food, clothing, electrical equipment, and other products. This kind does not have several shops and is bought or operate as a single unit by a single establishment [9]. Hence, in this type of shopping centers, the type of shopping here is limited and more focused on one or two types of goods.

When it comes to distinguish between the term of shopping mall and shopping center, then we must talk about structure that contains the mall: The structure of the Centre can be opened, on the contrary of shopping malls, which is closed and climatically controlled. In addition, shopping center is self-serviced center, where the users get their things for themselves rather than being served by another person in this case it can be called a supermarket. As [9], [10] asserted that a "supermarket" is a "self-service shopping area controlled by a single store, trading a large selection of convenience and comparison items, food, and non-food." It could be a "one-stop" out-of-town business with plenty of storage, frequently including eateries, tires, batteries, and auto accessory bays, and fueling station.[9].

In the case of this research, despite being delayed to the mall trend, growth, and proliferation, Amman, Jordan, shares the newest global shifts and advancements, whether positive or negative. Malls did not arise at the same rate or through the same development process as they did in the United States and Europe [11]. Amman's modern modest stores expanded into super markets in the las two decades, then into shopping complexes and shopping galleries, and then into mega malls not long after [12]. Currently, the most popular type of shopping centers in Amman is type I which consist of shopping malls with a variety of stores for food, clothes, warehouse equipment, drug stores etc. [12]. Therefore, this research focuses on shopping malls type I.

HISTORY OF SHOPPING MALLS/CENTERS

The notion of a shopping mall has been around for over 2,000 years, and it is still alive and well in the modern retail mall, albeit in a much larger and uniform form. Trajan's Market in Ancient Rome was the first true commercial mall, erected roughly 100 years ago. It was a predecessor to current shopping mall. (Grand Bazaar of Istanbul), which was constructed in the 15th century, this bazar is considered as one of the oldest commercial centers. It is currently one of the biggest retail centers in the world, it is consisted of with a capacity of over 4,000 stores and 58 streets. Later, with a growth of the automobile and the suburb, a new type of retail center developed, further away from downtown [13], [14].

Massive tax breaks prompted investors to join and build shopping complexes. The concept of a suburban shopping center evolved significantly after World War II, but it wasn't until the mid-1950s that the first fully enclosed shopping mall appeared. The Valley Fair Shopping Centre first opened its doors in 1955. However, a regional-sized, completely enclosed shopping center did not open until 1956. Malls would soon shift retailing away from commercial, crowded downtowns and into large residential suburbs. The times had changed [14].

As mentioned before, Amman's mall history is brief, and its development was not influenced by local precedents or traditional marketplaces, nor did it progress at the same rate as malls in Europe or the United States [15]. Figure

(1) below shows the current distribution of malls in Amman city.

FIGURE 1. the current distribution of malls in Amman city. Source

Real retail malls did not appear in Amman's neighborhoods and districts till the mid-1990s (when the government had removed its subsidies and control over food imports and prices) [12], [16]. The C-Town group's Amman Mall was the first one to introduce shopping malls to Amman, albeit with an oriental twist [12]. The mall was divided into twisted lanes, small courts, kiosks, small stores, and outdoor arcades by the architect, who was noted at the time for his Islamic-Oriental design. The mall drew only tiny investors, and shops were rented only to local businesses and not to household names. Its impacts were lessened by its design, location, and rising business competitors on Al-Gardens (Wasfi Al-Tal) street, and people were drawn to it as part of the street growth. Figure (3).

FIGURE 2. Amman Mall Arcaded Twisted Galleries. Source

The subtle and airy silk cut sensation seen abroad or in movies was not available to mall visitors at Amman Mall [12], [17]. The traditional mall experience with free open spaces, multi stores, atriums, escalators, panoramic lefts, and many well-known mall trademarks will be inaugurated at Abdoun Mall in Abdoun, Amman's wealthiest district. Abdoun mall drew not only wealthy locals, but also middle- and low-income citizens from Amman's poorer south and east neighborhoods [17], [18]. This was short-lived. Two years later, Abdoun Mall was dethroned by a much larger mall. The first typical, all-user, all-facilities shopping center in Amman was Mecca mall, which was named after neighboring Mecca Street. It offered a variety of entertainment, enjoyment facilities, and services in addition to all types of commodities and shops as shown in figure (3).

FIGURE 3. Abdoun Mall First Real Experience. Source

The Mecca mall's success story drew not only people from all across Jordan, but also developers looking for properties close to or near it. The C-Town Amman mall company has built a new branch not far from Mecca mall's main entrance, only 30 meters away [16]. Another well-known retailer, Carrefour, and City Mall, a brand-new mega-mall, built just 200 meters away with a soft opening to capitalize on the mall craze [16], [18].

FIGURE 4. Malls Clash's City vs Mecca. Source

As shown in the historical development of shopping malls in Amman city, it was clear that the choice of shopping malls location in Amman city has nothing to do with its type or with a preconceived plan or city structure, whether in districts or the city center [19]. Besides the site localities or districts, the spread of malls on specific sites or places followed no plans, laws, or restrictions. There were no studies or master plans that provided developers with suggestions or forecasts about how their malls will alter users' attitudes or behaviors, old markets or old malls, or nearby or far urban vicinities and environments. Each mall's sizes, varieties, and amenities did not follow any spatial or urban order or pattern [12], [16], [19]. Therefore, investigating the impact of the shift from the downtown shops to the shopping centers on the social life and Urban fabric has become an essential need to reduce the negative impact of shopping centers on Amman city fabric.

The Current Value of Shopping Centers/Malls

Nowadays, shopping malls, which are now seen as revitalized urban centers, serve as retail, social, and community centers, containing restaurants, offices, stores, and movie theaters [20], [21]. Therefore, shopping malls have a greater influence on the field of business than traditional marketplaces, they are considered as a simple supply and demand convergence. Shopping centers draw buyers, merchants, and consumers by giving them enough time to think things through and a stimulating environment in which to purchase. Recently, there has been competition between malls and traditional markets, prompting mall developers and management to try various techniques of creating an exciting environment for customers.

Although a lack of planning as well as direction has resulted in uncontrolled expansion and overcrowding of marketplaces, that has an impact on the growth of the merchants, shopping malls and hypermarkets have emerged as an important vital component of the urban environment. [22]. A bigger mall can accommodate a wider range of stores and therefore could improve the customer's shopping experience by luring visitors in and keeping them there more.

Reference [23] noted that this claim brings up a problem that administrators of shopping centers outside the typical retail corridor must deal with: how to get customers to their centers.

Factors Encouraging the Development of Malls and Shopping Centers in Amman City:

Shopping malls were built in Jordan's cities, including the capital Amman, due to a variety of circumstances. The following explains these factors:

1. The growth rate of population in Amman, which is rapidly increasing due to a political, and social factors.
2. Urbanization and altering consumption patterns": As Amman's total population grows, so does the proportion of the city's population. Consumption habits are changing as a result of rapid urbanization. The people are consuming new goods that are fitted to their new urban lifestyle. The majority of these items are foreign imports, demonstrating a sharp decline in the use of local goods.
3. Increase in consumer income and spending power; the more the purchasing power, the larger the demand for goods and services; trade thrives, and commercial investment is in high demand.
4. "The development of a highway network": Easy access via paved roads for private cars is a crucial criterion for developing a retail center/mall. The expansion in the number of vehicles, as well as the vast construction of the paved road network, has substantially driven the retail boom, and has expanded the information entail area of marketplaces and shopping entrées.
5. "The state's goal to broaden its economic base, economic globalization, and improved investment conditions".

THE IMPACT OF MALL ON URBAN PLANNING AND HUMAN BEHAVIOUR

1. From an economic standpoint, shopping malls cost the city municipality more money because of the entire cost of these facilities' services in regards of energy and many other infrastructure amenities
2. Shopping malls generate occupations which simply call for minimal skills and, as a result, pay low wages; as a result, cities with major shopping malls typically have high percentages of family poverty, which began to emerge in Amman.
3. Small businesses in the surrounding neighborhoods are driven out of business by the mall, increasing the city's unemployment rates [24].
4. Shopping centers have a negative impact on the environment because they increase the need for sewage and water infrastructure, contribute to noise and air pollution, and create traffic jams, as was recently observed near Mecca Mall.
5. Shopping centers increase consumption in Greenfield by using a lot of pavement for parking, reduce the area's capacity to sustain life, particularly in terms of open space, and reduce the amount of pedestrian traffic in the streets around them. [24] [25].

MATERIALS AND METHODS

As this research is qualitative in nature, it aims to investigate, the impact of the transition from the down town shops to the shopping centers/malls on the social life and urban fabric of Amman city, the study follows the qualitative approach using a questionnaire, which was answered by 100 respondents among a period from March to August 2021. Face-to-face interviews conducted by researchers using a standardized questionnaire with closed-ended questions were utilized to gather data. The main objective of the questionnaire was to obtain more information and interpretations about the topic and context of the study. In this regard, the questions were oriented to find out more about the impact of the transition from traditional retiles to shopping malls. The topics discussed varied between city density issues, inclusiveness, public spaces and streets, Amman health care systems and strategies, and migrant population movement, as well as, travel and truism issues. The users of markets and shopping malls were asked the mentioned questionnaire during their visits to those places.

SURVEY INSTRUMENT

The survey form consists of three main sections with a total number of 27 questions, each addressing a specific subject related to the study. The first section refers to the basic general demographic information with objective questions. While, the other five sections were specified and ordered in a sequential manner, which moves from the

broader concerns of shopping malls in Amman city to the more particular aspects transition from downtown small shops to mega malls impact. In that sense, each segment represented a specific area of concern. Each of the three sections created both subjective and objective inquire. In this questionnaire, respondents asked to indicate, their level of satisfaction of each suggested statement or question. The answers range between five possible values: highly satisfied (1), satisfied (2), neutral (3), dissatisfied (4), and highly dissatisfied (5).

METHOD OF ANALYSIS

Descriptive frequencies were used to investigate the impact of the transition from downtown shops to shopping malls in Amman city. Logistic regression and multivariate analysis were used to examine the personal, situational, and site factors that led to the change of shopping patterns to shopping malls. All analyses were conducted using SPSS 24.0 and significance set at $p < 0.05$.

CASE STUDY OF AMMAN CITY IN JORDAN

THE CONDITION OF RETAIL IN GREATER AMMAN CITY

The retail area of Amman, the country's capital, is estimated to be 6.34 million square meters, or 0.317% of the world's total, and it consists of a variety of commercial spaces, include historic bazaars, standalone stores, and shopping centers according to (Building Permit Department at GAM, 2006) records. Around 11% of Greater Amman's total gross floor area is dedicated to retail, which is according to international standards [26]. Amman's retail trade has undergone a remarkable transformation and entered a new stage, symbolized by the rise of shopping complexes.

THE IMPACT OF TRADITIONAL SHOPPING CENTERS AND SHOPPING STREETS:

Traditional market districts, particularly downtown Amman, are home to traditional retail establishments such minimarkets, grocery stores that solely sell food, and other shops that offer apparel, home products, and other items.

Old streets and bazaars, which were once used by craftsmen to supply and sell their wares, are now used for shopping from a variety of stores such as boutiques, dress shops, restaurants, coffee shops, whole sale stores, agencies for manufacturers of cameras and computers, banks and travel agencies, and so on. As a result of industrial change and transitions, new types of bazaars were formed, and civic life was expanded in order to serve consumers and provide adequate distribution.

Traditional markets continue having significant benefits in different industries and commodities, they strategically adopt definite socioeconomic strategies to compete with large malls and retail centers. All of changes mentioned before in the retail trade sector contribute to the formation of new shopping patterns and the distribution of shopping facilities on a level of local and regional scale [27].

Shopping centers are comparable to traditional local markets and stores in that they are set up in specific locations but are often much smaller in size when compared to malls.

Shopping at local markets is more pleasurable for many buyers to buy fresh items with competitive rates.

It is preferred by people with low income, more than high income people such as down town.

These kinds of places have an emotional impact for its old history in people’s minds so it keeps reminding them of these beautiful memories.

AMMAN DOWNTOWN

For those on a tight budget, the ancient downtown, or Wasat Al-Balad, Arabic for "city center," is the place to go (refer to figure 5 and 6). There, shops sell out-of-date designer clothes, handbags, and shoes from labels like Prada, Gucci, and Louis Vuitton for as little as one-tenth the price of the same items in the country's malls or abroad as shown in figure (7). The seven mountains which originally made up the capital were all around the historic downtown, which was built in 1920 in the lowest wadi of the city. Jordan's most populous city, Amman, expanded into a massive, global

hub that now houses half of the nation's 7.5 million residents. [27].

The old downtown remains a major destination for many people (citizens and tourists), not only for business or shopping, but also for outings, due to its reasonable pricing, variety of items, and historic identity. After eating burgers and fries for lunch with some friends, I remarked, drinking spiced black coffee, "Downtown Amman has a unique blend of old and modern, that you can't get somewhere else in city and definitely not the so-called New Downtown."[25].

Many Jordanians focused on ancient downtown's traditionalism, which may be turned to the dark-yellowish limestone buildings that line the area's lively and narrow streets and steps as shown in figure (8). There, modern conveniences such as computer games, internet cafés, and fast-food restaurants coexist alongside traditional smoke-filled coffee shops, antique stores, and vegetable, meat, and fish markets.

A great Husseini Mosque, that is also known as the King Hussein Mosque, is considered as in Amman. It was constructed in 1924, shortly after the county was established as the Emirate of Trans-Jordan, a minor British protectorate. The historic downtown still houses some of Jordan's most important institutions, including the offices and residences of some members of the ruling Hashemite family, the Central Bank of Jordan, and the Ministry of Finance [27].

There are several traditional eateries, coffee shops, and movie theaters showing X-rated films for excursions. Internet cafés are regularly packed as well, especially on Thursday night, the start of the weekend in Jordan. A public park is periodically crowded with young people chatting while enjoying a cup of coffee or ice cream in front of the old Roman Amphitheatre of the historical city. [25], [27].

FIGURE 5. Street view. Amman. Source

FIGURE 6. open-air-market-commercial-quarter-western. Source

FIGURE 7. Pedestrian and traffic flow, Amman. Source

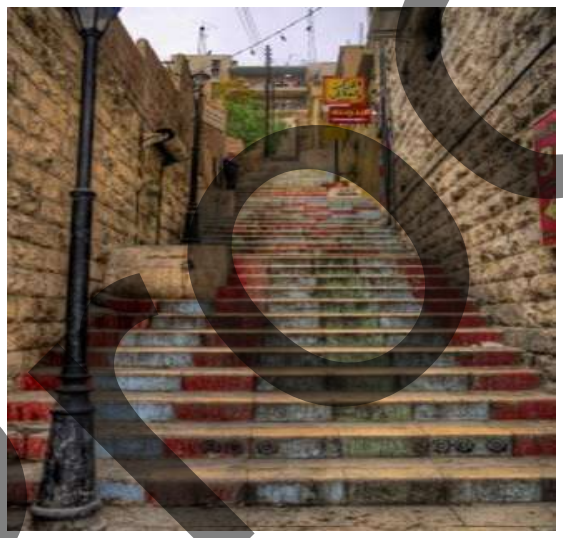

FIGURE 8. Amman steps. Source

RESULTS

QUESTIONNAIRE RESULTS

1. The majority of consumers have the same attitude that they like shopping at contemporary retail establishments. They stated that the numerous product types with consistent quality, the clean and welcoming environment, as well as the kind treatment from the staff, are what draw them to modern retail stores. In addition, people like conventional stores because of the accessibility and inexpensive pricing.
2. Between daily necessities to monthly necessities, both conventional and contemporary retail stores occasionally offer comparable items. The majority of the consumers said they buy at traditional stores for basic items like food. Modern retail stores, as opposed to older ones, became the go-to locations for people to purchase more than food products their monthly necessities.
3. The majority of the interviewees stated that they enjoy shopping in contemporary retail stores since they are

warm. Air conditioning is a constant feature in modern retail stores, ensuring that customers are comfortable while they purchase there. Another interviewee stated that she prefers to shop in contemporary retail stores because the merchandise is well arranged there. Additionally, contemporary retail stores run promotions that are more aggressive than those of older stores. When compared to identical products provided in contemporary retail shops, buyers prefer traditional shops because of the lower prices.

4. The respondents in the interview stated that the greater price than in traditional shops is the aspect of shopping at contemporary retail stores that they detest. The price of the goods at the cashier occasionally differs from the price displayed in the display window. Contrarily, traditional stores also have flaws that make customers detest purchasing there, like how traditional market vendors behave.

DEVELOPMENT PROPOSAL VISION

After reviewing questionnaire results, the following are some modifications suggested by the authors based on users' opinions:

1. Maintaining the historical core of Jordan's capital city.
2. Revitalize the commercial area, through protecting traditional retails and provide new types of retails.
3. Create vibrant gathering space for events and festivals.
4. Provide secondary employment centers.
5. Creating a Shopping and Entertainment Destination, and integrating facilities with future growth and adjacent neighborhood.
6. Improve the pedestrian environment, widen sidewalks too.
7. Minimize surface parking.
8. Introduce a unified signage system.

Tables (1) and (2) summarized questionnaire results in the situational and site analysis factors sections

TABLE 1. Situational factors result. Source: the researchers,2021

SITUATIONAL FACTORS	HIGHLY SATISFIED	SATISFIED	NEUTRAL	DISSATISFIED	HIGHLY DISSATISFIED
Shopping experience at modern retail shops and shopping malls	35	20	5	30	20
Shopping experience at traditional shops at city centers	42	20	8	14	16
Prices at modern shopping malls/ centers	8	14	8	28	42
Prices at tractional shops at the city center.	35	25	10	10	20
Goods quality at the modern shopping malls/ centers	33	22	10	25	10
Goods quality at traditional shops at the city centers.	10	30	10	20	30

TABLE 2. Site factors results. Source: Researchers ,2021.

SITE FACTORS	HIGHLY SATISFIED	SATISFIED	NEUTRAL	DISSATISFIED	HIGHLY DISSATISFIED
Easy access to shopping markets in the city centers.	5	20	17	33	25
Parking is available in the city center.	2	9	17	51	21
Traffic regulation in the city center.	5	25	15	30	25
Comfort and enjoyment in the city center.	25	20	15	15	15
The variety of activities and events you can do around the shopping centers near city center.	18	15	15	32	20
The extent of enjoyment in the city center compared to the commercial complexes and shopping malls.	30	23	17	20	20
Provides security and order	6	9	22	35	28
The cleanliness of the site and availability of public facilities in the city center.	2	22	20	36	20

CONCLUSION

The study was conducted in capital city of Amman, which was discovered due to its location and surroundings of a place, such as physical surrounds, temporal perspective, task definition, social surroundings, antecedent state, and shoppers' mood produce hedonic worth in the minds of customers. According to the research findings, the study was conducted in Jordan's central region, and it was discovered that fundamental aspects such as physical environment, temporal perspective, work description, social environment, and shopper mood generate a radical value in the thoughts of shoppers.

The results of the research reveals that the poor transport network and the crisis of suffocation and lack of traffic regulation led to a great reluctance to go to the city center. In addition to the absence of activities and events and after vital facilities as well as to the absence of activities and activities and after the vital facilities from each other and the lack of services and basic requirements and the presence of rugs and stampede and pavement crisis led to the reduction of visits to the country and to go to shopping center

The emergence of shopping malls in Amman is linked to a variety of variables, along with a population growth as well as high urban growth, an increase in performance in the population's economic situation, a shift in consumer actions, the creation of international investment options, the growth of infrastructure (especially public transport and energy), and the conventional markets' continued significance in luring customers buying local and traditional goods, including such clothing and telecommunications. Additionally, traditional markets serve as venues for social interaction and the resuscitation of social networking sites in addition to being locations for buying and selling. Public places should be "accessible." The visual and physical connections an accessibility has to its environment identify it.

A successful outdoor public place is visible from afar and is adjacent to and handy to public transportation. Furthermore, the space's borders are important. For example, walking down a street with stores is more exciting and safer than walking down a street with blank walls or an empty lot.

Modern retail stores are more often frequented by customers than conventional stores. The contemporary retail

store, on the other hand, offers several advantages that consumers cannot dispute. For instance, installing air conditioning in contemporary retail stores makes buying more convenient. Installing CCTV also makes shopping more convenient for customers since they feel safer.

RECOMMENDATION

After a thorough analysis of data, the researchers came out with the following recommendations are hereby made.

1. The traditional market might enhance its capital so it can offer a wide variety of products in order to prevent the emergence of contemporary retail stores.
2. Traditional retailers should emulate modern retailers' excellent service in order to keep their existing customers.
3. Young shoppers like traditional stores since they are less expensive than contemporary retail stores. Traditional businesses must continue to make this beneficial argument in order to retain their customers.
4. Through identifying the variables which have a substantial impact on how consumers make decisions, more investigation may be done to analyze buyer behavior in detail.
5. This research project solely looked at the factors that led customers' preferences for shopping locations to move from conventional shops to contemporary retail shops. Additional research relating to customer behavior could be used to do more research.
6. Individuals must participate in "activities," which are the cornerstones of an outdoor public space and provide visitors with a cause to come. In other words, if a public area is vacant, there's something totally incorrect with the architecture of the space or with how it is being managed.
7. The area needs to be "nice" and "identifiable." The degree of comfort and appearance of a public area serve as indicators of its success. Safety, cleanliness, and the availability of seats are factors that contribute to comfort. The conceivable parts of the city are defined by the meanings that create our surroundings. It is important to create a feeling of place identity and continuity in order to increase the intelligibility of public places.
8. It must be a "social" area where guests may congregate. While preserving socialization is a difficult quality for a place to acquire, outdoor public spaces would benefit if it is provided. In other words, individuals feel more at home or connected to their community if they encounter friends, meet new people, and feel comfortable approaching strangers.

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DISCLOSURE STATEMENT

Authors don’t have any competing financial, professional, or personal interests from other parties

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CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest

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Dual-Layer Electromagnetic Band Gap (EBG) Structure Loaded Dual Band Notched UWB Antenna

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Abstract: This research article demonstrated a dual-layer *Electromagnetic Band Gap* (EBG) structure integrated with an *ultra-wideband* (UWB) antenna to produce dual bandstop features. A sandwiched *Rectangular Mushroom Shaped* Electromagnetic Band Gap (RMS-EBG) is implemented between two 0.8mm thick FR-4 layers to create band stop features for the WLAN band. A *Symmetrical Pair of Split Ring Resonator* (SPSRR) structure is used as EBG near the feed line on the top layer to create a band notch for X-band (downlink). The antenna presents a minimized cross-polarization power level and low RF power leakage. The measured and simulated results are investigated for band notching characteristics in terms of VSWR, group delay, and radiation characteristics.

INTRODUCTION

THE wireless communication is the fastest growing technology, and it has evidenced the most advancement in the last two decades, particularly in short-range communication systems. After the Federal Communication Commission (FCC) declaration as UWB an unlicensed band for commercial uses [1], it is demanded in industries due to its unbeatable features in short-range communication. It has become a trusted area for research in academia due to the unlicensed band and has a broad scope for improvement. However, the UWB system performance is significantly vitiated owing to the electromagnetic interference (EMI) generated by narrowband systems like WLAN, WiMAX, and X-band. Numerous approaches were previously presented, like bandpass filter integration with antenna systems or frequency selective surfaces over the antenna and many more, but designing an antenna with band filtering features is most popular. In literature, researchers have suggested several techniques to create an antenna with band filtering features such as slots etched on metallic patch or ground plane, defected ground structure (DGS), slot in the feed line, stubs methods, split-ring resonators, EBG, and many more [1-11].

The EBG technique is one of the most general techniques for making an antenna with band filtering features. In literature, several types of EBG configurations are available like, dual slotted EBG with double via [2], a mushroom-shaped EBG near feed line in [3], an edge located EBG near feed line to produce band notch at WLAN band [4], an inverted double U-slotted EBG arrangement is presented for band notch in [5]. Also, an asymmetrical edge located EBG configuration is presented in [6] to produce dual-band notch characteristics, an EBG structure with CPW fed antenna presented rare side of the patch to produce rectangular notch at WLAN band in [7], a mushroom-shaped EBG and its modified version of I-shaped slotted EBG near the feed line for band-notched features in [8] and a spiral-shaped edge located EBG near feed line in [9]. Mushroom shape EBG integrated with a slot in [10], a reconfigurable EBG in [11]. Many other band filtering methods combined with UWB antenna are available in the literature; however,

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CSRR/SRR and slot methods are preferred due to their high-quality factor feature. Some of them are discussed here like, the integrated slot method is used in [12-13] to produce triple band-notched features, whereas along with slots on patch, open-ended stubs are used in [14]. A multilayered CSRR topology is implemented in [15] for multifunctional UWB features. The authors in [16] designed a MIMO configuration for slit and slot loaded UWB antenna for band-notched features. In [17-18], authors have etched alphabetic letters shaped slots to produce band-notched. In [19], a folded resonator produces a band-notched resonating element and a slot on patch or ground. The concept of EBG is used to produce band filtering characteristic in UWB antenna by authors in [20]. In literature it is proven that the split ring resonator produces the negative permittivity and same concept is used by authors in [21] to produce band notched features with UWB antenna.

This paper presents the dual-layer EBG structure analysis to produce band-notched characteristics in the UWB spectrum, which minimizes the electromagnetic interferences caused by narrowband applications like WLAN and X-band. The SPSRR near feed line connected with ground through via a sandwiched RMS-EBG (Metallic post) is used to create band notch functions for X-band (downlink) usages. The RMS-EBG is sandwiched between two FR-4 substrates connected with ground through via to produce band notch characteristics for WLAN applications. The SPSRR approach enhances the antenna characteristics and minimizes the electromagnetic interferences from narrowband applications. The EBG method to create a band stop feature has the advantage that it can control the band stop resonance frequency. However, this feature can be improved by the benefits of SRR as proposed in the current work. The band stop resonance frequency can be controlled through the size, orientation, and split gap of the SRR. In the presented work, SRR is demonstrated as an EBG element, so it holds tuning the resonant frequency of the stopband. It also reduces the RF power leakage from the radiating patch caused by the different slots on the patch/ground. In literature, various works have been presented to produce band stop features in UWB antenna using slots on radiating patch/ground, which increases the RF power leakage from the antenna. However, in this paper, SRR has been implemented with EBG configuration to reduce the RF power leakage. The RMS-EBG (Metallic post) produces the band notch feature and provides the unique method to connect ground with SRR near the feed line. The proposed design has asymmetric via diameter, differentiating the effective inductance to create the band stop frequency. The proposed approach is also helpful to design metasurfaces and frequency selective surfaces which sandwiched metallic patches to tune the desired resonant frequency.

BAND NOTCH ANTENNA SIMULATION AND RESULTS ANALYSIS

The suggested antenna model and its characteristics investigation have completed with commercially available EM simulator "Ansoft's HFSS". The recommended antenna's dimensions and necessary design variables are exhibited in Fig.1, and the fabricated antenna sample is depicted in Fig.2. The presented antenna is fabricated on the cost-effective dielectric material FR-4 (two 0.8 mm thick layers) with an overall substrate height of 1.6 mm, $\varepsilon_r = 4.4$ and loss tangent of 0.02. The antenna produces dual bandstop characteristics and is finished in three steps, as discussed in segments A, B, and C. The input port impedance of 50 Ω for the feed line is achieved by 1.4 mm wide metallic strip with an overall size of the proposed antenna 20x26x1.6 mm^3. The design parameters of the antenna are mentioned in TABLE 1.

TABLE 1. Optimized sizes of the Suggested Antenna

Parameter	Size (mm)	Parameter	Size (mm)
W	20	g	0.5
L	26	W_2	5
D	13	L_1	7
R_1	1.2	L_2	4.5
R_2	2	L_3	5.6
W_1	1.4		

CIRCULAR RADIATING PATCH (UWB ANTENNA)

The primary antenna is a circular radiating patch with a partial ground length of 3 mm. The radiating patch is etched on the front side of layer-2, and the ground placed rare side as displayed in Fig.1. The

designed antenna structure radiates over the 3-10.7 GHz band, which includes the UWB spectrum (3.1 to 10.6 GHz) with a good VSWR value less than 2, presented in Fig.3.

RECTANGULAR MUSHROOM SHAPED EBG (RMS-EBG)- SANDWICHED METALLIC POST

The symmetrical pair of RMS-EBG (EBG-1) cells are sandwiched between two FR4 layers as displayed in Fig.1 (b), and its side view is presented in Fig1.(a). An RMS-EBG cell pair (Metallic post) grounded using via is implemented to create band notch at WLAN applications (5.1-5.8 GHz). The total size of the RMS-EBG cell is 4.5x5 $mm^{2,}$ and a manufactured model of the suggested antenna is presented in Fig.2. The practical length of the EBG-1 can be calculated from the equation (1).

$$L_{eq} = 2(L_2 + W_2) \tag{1}$$

$$f_{5.5\text{GHz}} \frac{c}{2*Leq*\sqrt{\frac{\varepsilon_r+1}{2}}} \tag{2}$$

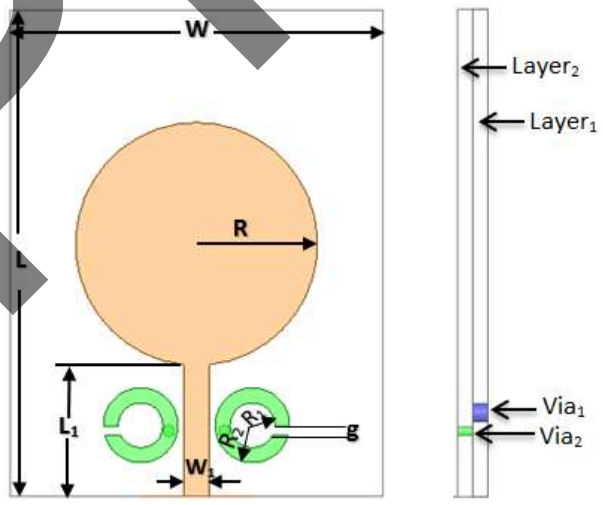
Where C is the speed of light. The calculated L_{eq} of RMS-EBG is 16.63mm whereas its practical Leq is 19mm due to the extra inductance created by the metallic via1.

SPSRR LOADED WITH EBG DESIGN (EBG-2)

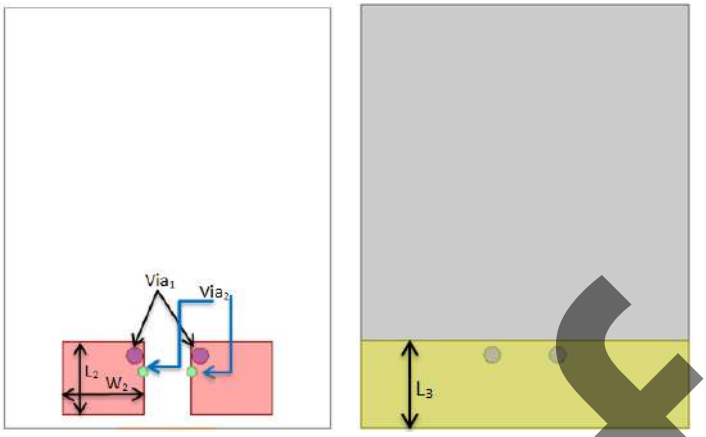
The band notch characteristic for the X-band (downlink) applications is achieved through the symmetrical pair of SRR loaded EBG (EBG-2) near the feed line on layer-2. Here a symmetrical pair of SRR metallic structures are connected with the sandwiched rectangular metallic patch through via2. The top side of the FR-4 (layer-2 with thickness 0.8mm) substrate accommodated a circular patch, and a pair of symmetrical SRR metallic structures and via2, whereas the rare side of the substrate is blank. The practical and calculated length of the SRR is approximately almost λg/2, calculated at 7.5 GHz is 12mm. The extension in resonator length is because of the other EM coupling influences on the patch radiator. The EBG-2 length can be determined with the equations (3) and (4).

$$f_{7.5\text{GHz}} = \frac{c}{2*LeqSRR*\sqrt{\frac{\varepsilon_r+1}{2}}} \tag{3}$$

$$L_{eq} = 2\pi R_2 - g \tag{4}$$

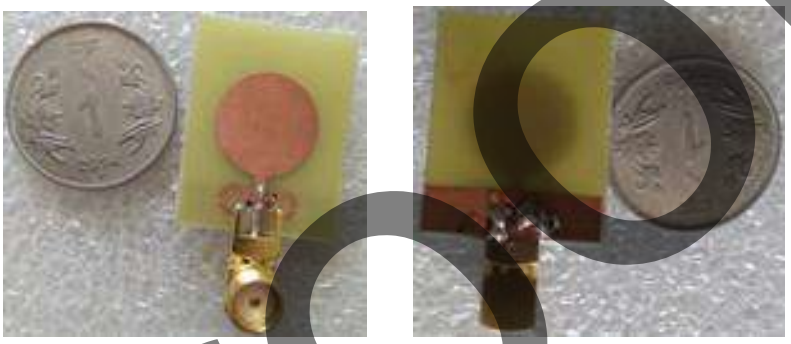


(a) Top and Side view



(b) Sandwiched view (c) Bottom View

FIGURE 1. Dual layer UWB antenna Model



(a) Top View (b) Bottom View

FIGURE 2. Fabricated Prototype of Dual Band Stop UWB Antenna

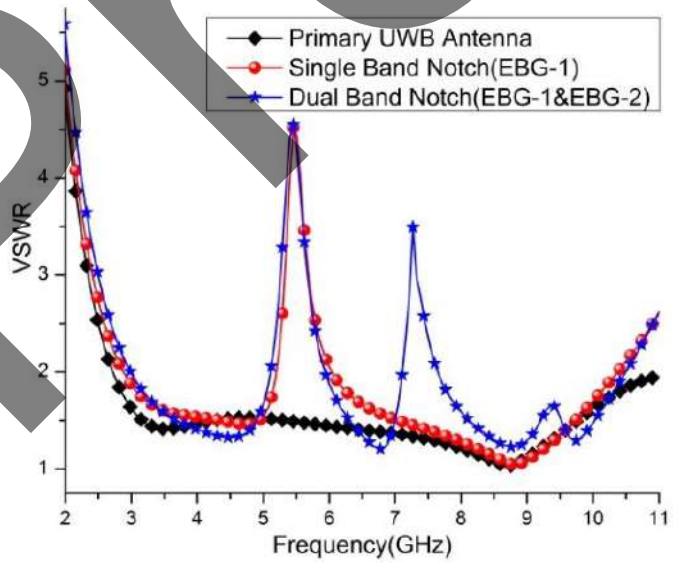


FIGURE 3. VSWR of EBGs Loaded UWB antenna

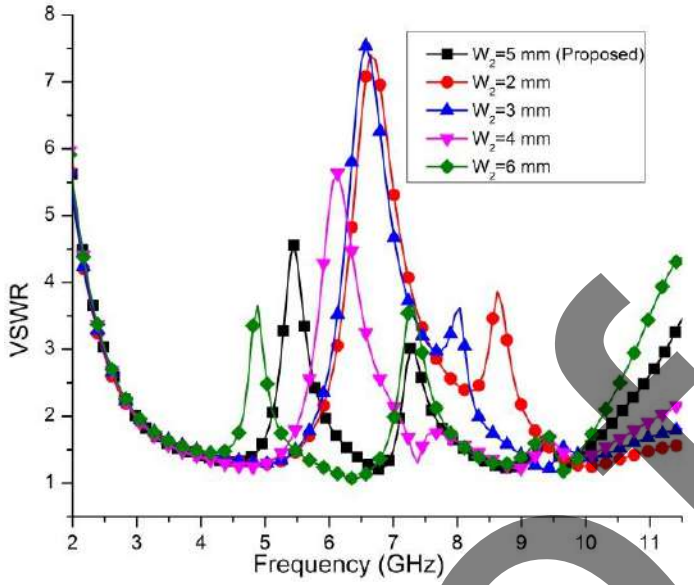


FIGURE 4. VSWR variation with EBG-1 Width

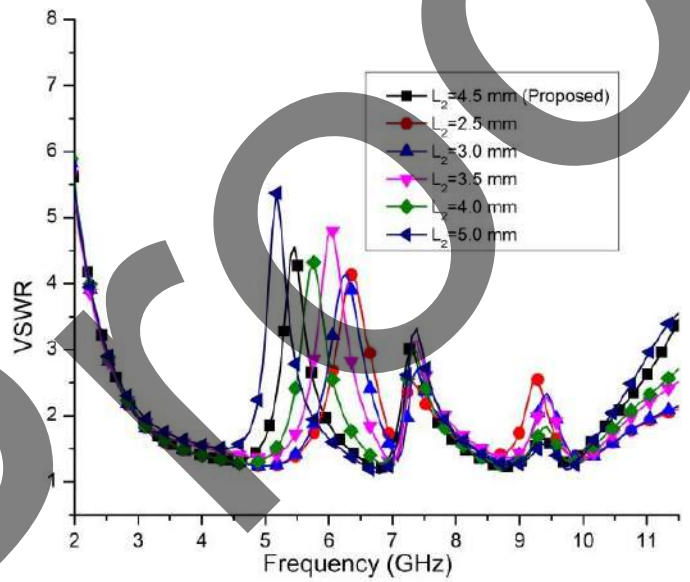


FIGURE 5. VSWR variation with EBG-1 Length

The RMS-EBG (EBG-1) length and width are altered to study its effect on band notch resonant frequency. Fig.4 and Fig.5 shows that the size of EBG-1 has a great impact on the resonant frequency of the stopband. The inductance of EBG-1 increases with the length and width of the EBG-1. The resonance frequency shifted towards higher frequencies, inversely proportional to the inductance. The inductance of EBG-1 is proportional to the length or width of the EBG metallic patch. However, it is observed that the variation in the length of the EBG-1 has a negligible effect on other band notch frequencies. In contrast, variation in width considerably impacts other band notch frequencies.

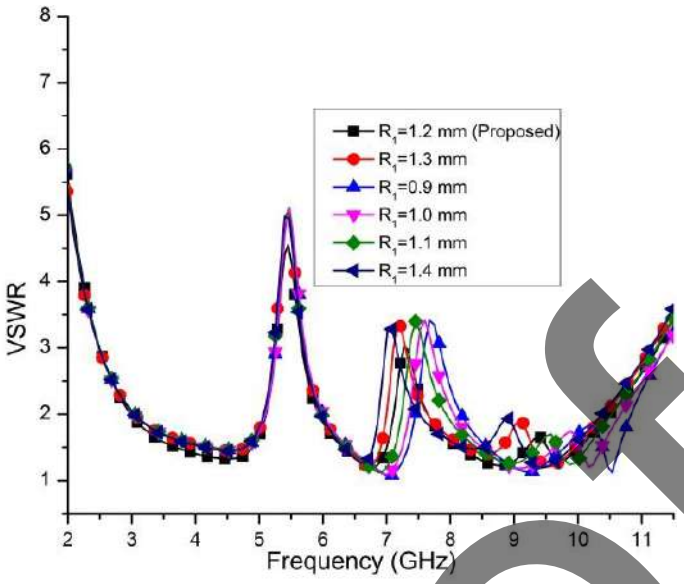


FIGURE 6. VSWR variation with EBG-2 radius 'R_1'

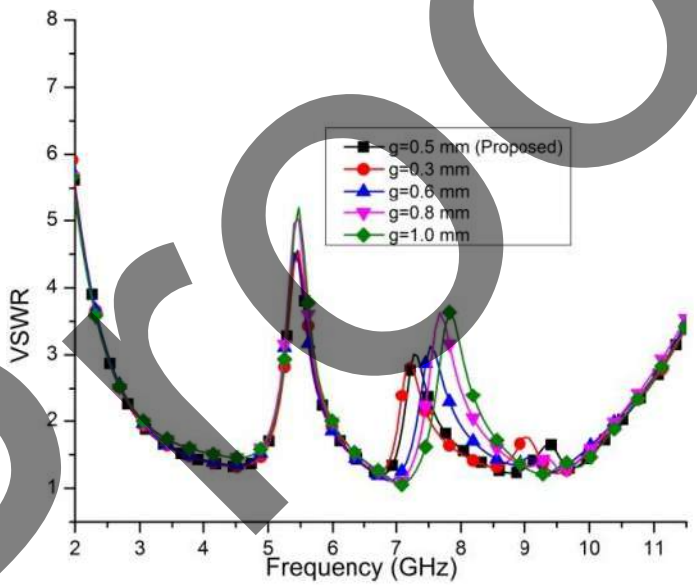
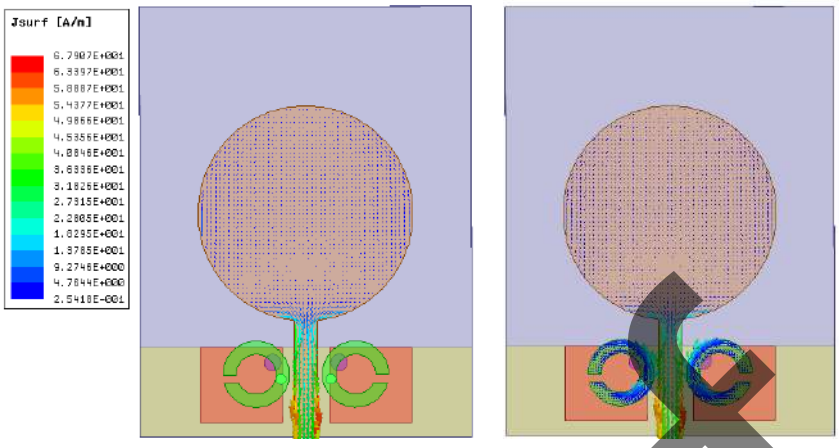
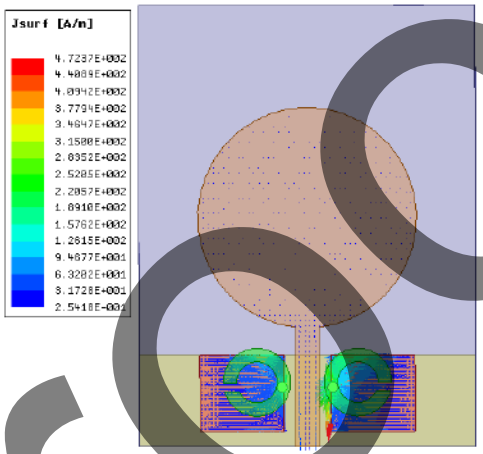


FIGURE 7. VSWR variation with EBG-2 SRR gap 'g'

The SRR EBG structure is placed on the top layer near the feed line to produce a band notch at X-band applications, and it is connected with the sandwiched EBG-1 through via2. The effects of SRR size alteration (ring width and split gap) on band-notched frequencies are presented in Fig.6 and Fig.7. The inductance of SRR varied with the thickness of the ring, so when R_1 increases, the inductance decreases, and the resonance frequency inversely shifts, as shown in Fig.6. The capacitance produced by SRR to create band filter characteristics is tuned with split gap 'g', and it increases/decreases with gap size. The resonance frequency of band stop is inversely shifted with the SRR capacitance value as presented in Fig.7.



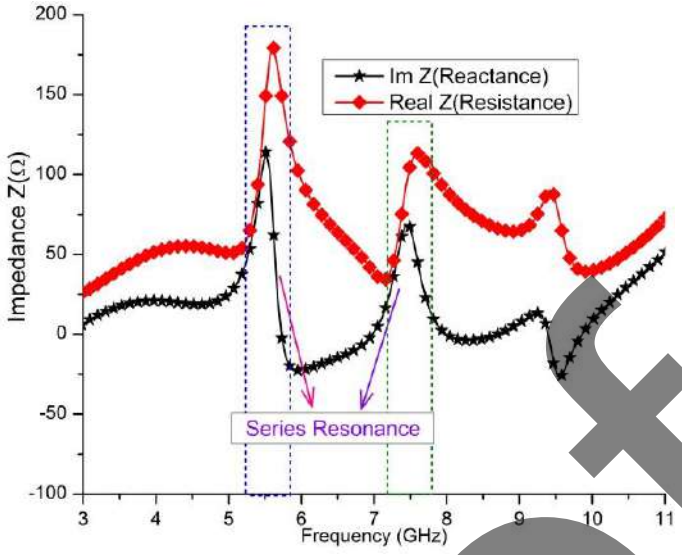
(a) 5 GHz (b) 5.5 GHz



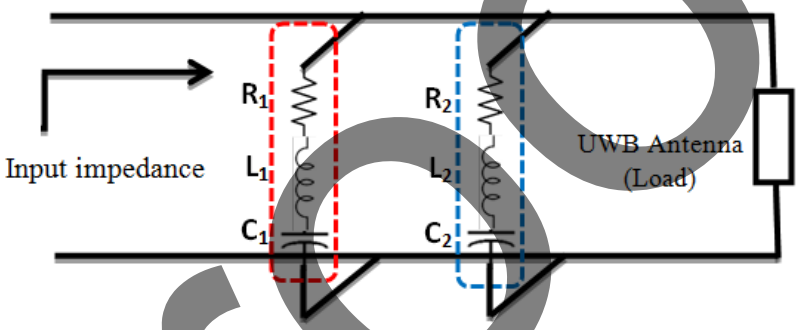
(c) 7.3 GHz

FIGURE 8. Current Distribution at Passband (5GHz) and Stop bands (5.5 and 7.3 GHz)

The effects of different band notching structures on the proposed antenna are examined with the vector current distributions and presented in Fig.8. At stopbands of frequencies such as 4 GHz, the circulation of the vector current is identical, as illustrated in Fig.8(a). The Fig.8 (b and c) represents the vector current distribution of SRR-EBG and RMS-EBG integrated proposed antenna. From Fig.8 (b and c), a high current density near the edges of the EBG structures are witnessed, which evidenced the impedance mismatching to produce band stop feature. It can also be observed from the impedance characteristics of the antenna.



(a) Impedance characteristic of antenna



(b) Equivalent Lumped Circuit Model

FIGURE 9. Input Impedance and Equivalent Circuit of Antenna

The antenna integrated with double EBG structures is produced the dual band-notched, its impedance characteristic is shown in Fig.9. It is evidenced that at notched frequencies, 5.5 GHz and 7.5 GHz antenna produces the resistance of more than 100Ω, and reactances are more than 50Ω. However, pass band frequencies have resistance around 50Ω and reactance of approximately 0Ω, which are necessary conditions for radiation from the antenna. The EBG structure on the antenna creates (due to positive derivates for reactances) series resonance to produce a band notch feature, and it is presented in Fig.9 (a). The series resonance due to the EBG structure is modeled equivalent to the lumped circuit model. The inductance and capacitance values can easily be modified with the SRR equivalent length, split gap 'g' and the orientation of the split. The lumped circuit model of the dual-band stop UWB antenna is exhibited in Fig.9(b).

MEASURED RESULTS AND DISCUSSION

The antenna characteristics like VSWR of the recommended antenna is measured with "Keysight *vector network analyzer"* and radiation characteristics performed in an anechoic chamber for E and H plane patterns. These measured results have acceptable similarities with the replicated results from the simulator. The disagreements among simulated and measured results are because of the inaccurate calibration of cable and tolerance limits of the fabrication process.

The suggested antenna's VSWR result (measured) compared with simulated is displayed in Fig.10. The presented antenna effectively produces dual band-notched characteristics and covers the UWB spectrum with a mandatory VSWR of less than 2 for other than notched frequencies. The compared E & H-plane patterns at 4.5 and 6.5 GHz for co and cross-polarization are displayed in Fig.11 (a-d). The presented antenna's radiation patterns (measured) show the proper matching with simulated results. The antenna fails its Omni-directional characteristics at higher frequencies

due to the RMS-EBG and SRR-EBG. However, the antenna has an acceptable cross-polarization power level, which evidenced the mitigation of RF leakage from the antenna. The antenna has a deficient cross polarization power level compared to co-polarization power, which makes it suitable for UWB indoor applications.

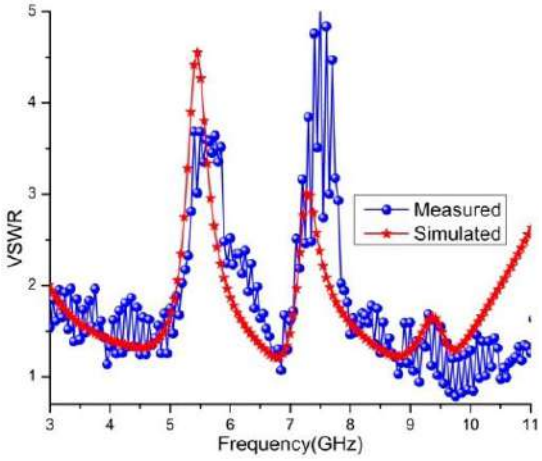
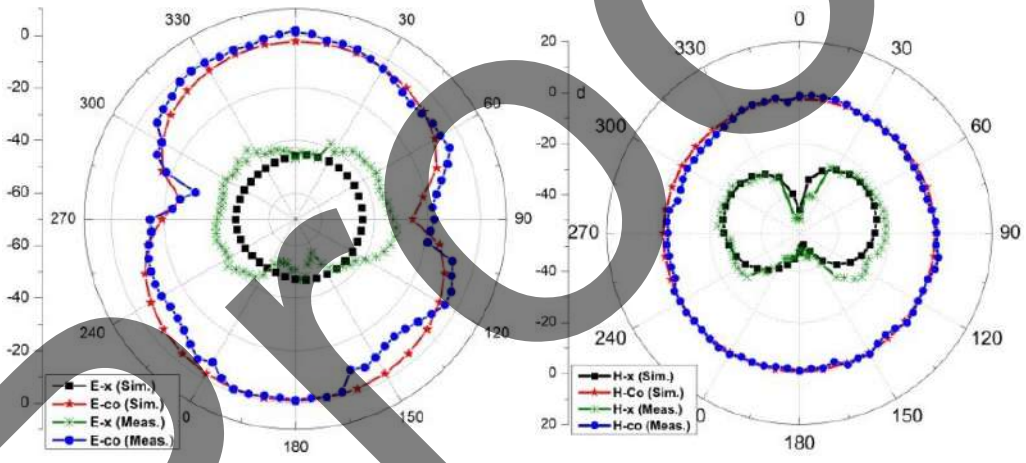
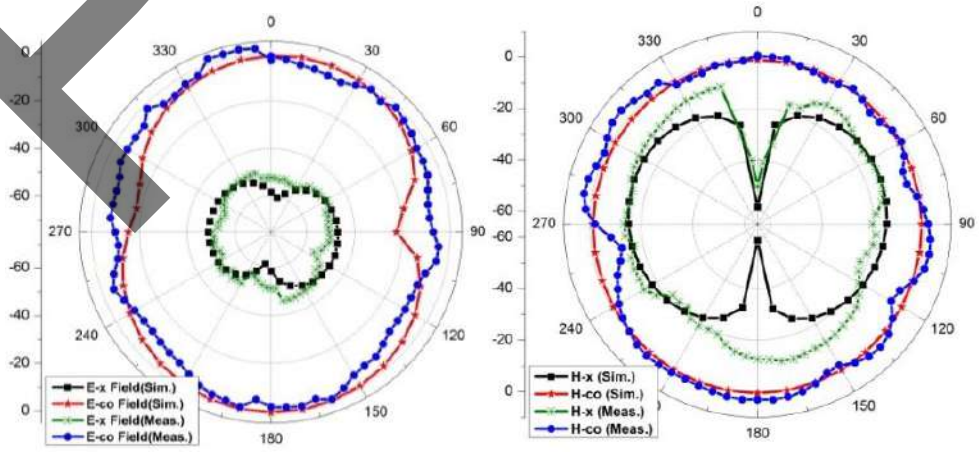


FIGURE 10. Measured VSWR and Radiation Pattern Measurement Setup



(a) E-Plane at 4.5 GHz (b) H-Plane at 4.5 GHz



(c) E-Plane at 6.5 GHz (d) H-Plane at 6.5 GHz

FIGURE 11. Measured and Simulated Radiation Patterns

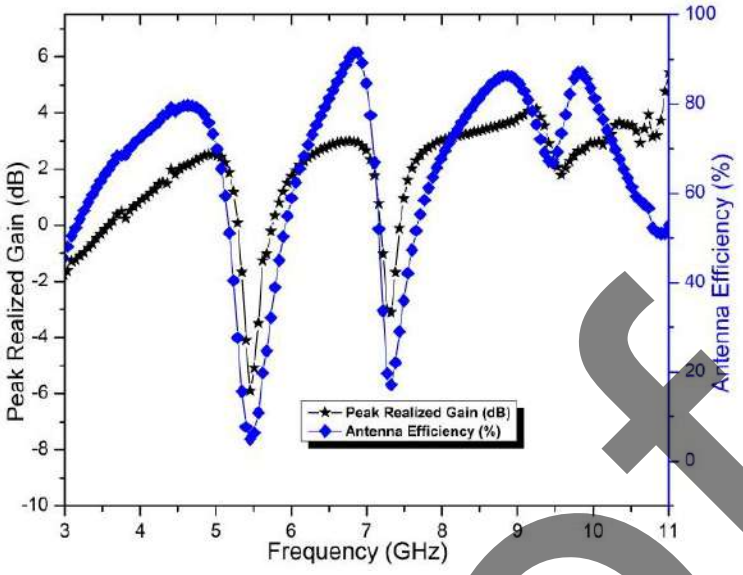


FIGURE 12. Realized Gain and Efficiency of Proposed Antenna

The proposed antenna is presented the radiation efficiency for passband frequencies at approximately 90%, whereas it is observed that the antenna has a radiation efficiency of around 15-20% for notched bands. The realized gain and efficiency is displayed in Fig.12, and it is witnessed that antenna gain is -5 to -6 dB for notched bands. The low gain in vicinity of lower frequencies is due to the antenna's small size and RF leakage due to the EBG structures.

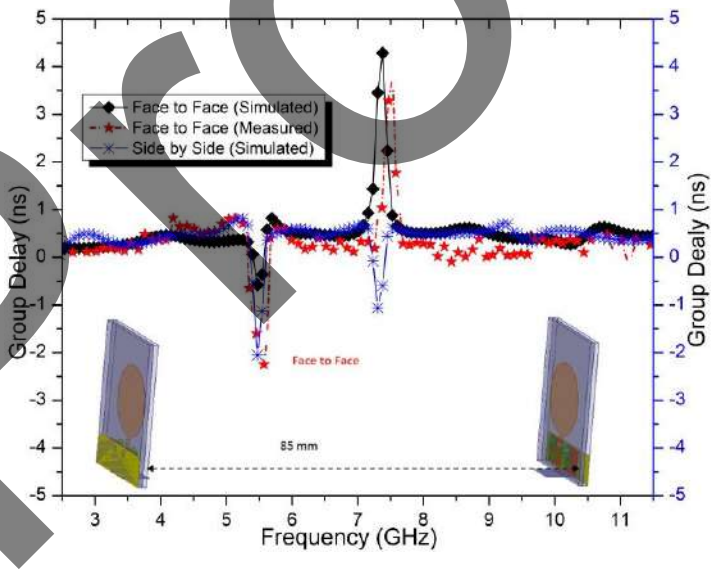


FIGURE 13. Measured and Simulated Group Delay

The antenna analysis for time-domain characteristics is presented in Fig.13 in terms of group delay. The antenna has a high approximately constant group delay for passband frequencies around 0.3ns which shows no phase deviation. In contrast, the band notch frequencies have a high group delay of around 3-4ns. The face-by-face group delay is measured and compared with the simulated antenna group delay result and observed satisfactory agreement.

The antenna analysis is compared with an available antenna with EBG structures and summarized in TABLE 2

TABLE 2. Comparison of the proposed antenna with recently presented antennas

Ref[]	Size	Permittivity (ε_r)	Notch Bands	Cross-Polarization
[2]	38x40x1.6	4.4	Dual (ISM band)	NA
[3]	38x40x1	4.5	WLAN	NA
[4]	35x39x1.8	3.38	WLAN	NA
[5]	35x39x0.813	3.55	WLAN	NA
[6]	32x52x1.6	4.4	WiMAX, WLAN	NA
[7]	48x50x1	2.65	WLAN, X-Band	NA
[8]	42x50x1.6	4.4	WiMAX, WLAN	NA
[9]	30x35x0.762	3.66	WiMAX, WLAN	Acceptable
[12]	25x30x0.762	3.66	WiMAX, WLAN, X-Band	NA
[13]	24x31x1.6	4.4	WiMAX, WLAN	NA
[15]	50x50x3.2	2.33	ITU, X-Band	Acceptable
[16]	39x39x1.6	4.4	WiMAX, WLAN, X-Band	Acceptable
[19]	19x32x1	2.65	WLAN, ITU and 10GHz	Acceptable
[21]	40x30x0.81	2.2	5G, WLAN, ITU	NA
Presented	20x26x1.6	4.4	WiMAX, X-Band	Acceptable

CONCLUSION

The antenna includes a UWB band and overcomes the interference glitches from WLAN and X-band uses. The SRR-EBG and M-EBG configurations have been effectively constructed to create dual band stop filtering features. Replicated results (simulated) are nearly similar to measured results, which validated the antenna for commercial applications. This antenna's effects and investigation specify that the SRR-EBG method is better than slot technique to create band notch at higher frequencies. RMS-EBG is a very comprehensive method to produce band notch at desired frequencies. The antenna demonstrated the low power level for the cross-polarization and improved RF power leakage due to etching on the radiating patch or ground plane. It is applicable in miniature devices, simple design & compact size as added advantages.

ACKNOWLEDGMENT

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Open Flow Packet in Message Monitoring to Prevent Flooding Attacks in SDN Environment

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Abstract. SDN is a programmable, centralized control network architecture. Although SDN supports automation, the flexibility of the network central controller feature is prone to distributed denial-of-service (DDoS) attacks. In flooding attacks, packet_in messages get generated in bulk which overloads the controller and results in controller failure. Therefore, it is a significant concern to confront the controller overloading issue in the SDN environment. In this article, we worked on Openflow packet_in message to control the traffic in the Ryu SDN controller. The approach will assist in speedy detection & reduces the controller consumption, and overheads while processing. Packet_in messages and destination IP features are considered for detection of the DDoS attack. The proposed mechanism is evaluated on the SDN Ryu controller and evaluation shows that the approach detects an attack in the early stage of an attack. Therefore, the proposed approach can minimize the controller overloading problem.

INTRODUCTION

Software-defined networking (SDN) controller(OpenFlow) provides the abstraction of hardware and software, sim-plifies provisioning, optimizes performance, and supports granular policy management. Due to these key elements, Openflow is a dominant protocol for SDN. SDN architecture acts as a backbone for next-generation technology such as 5G networks, wireless networks, data centers, and industry 4.0 [1]. SDN is a great option for efficient network man-agement [2] in a large and complex network. However, a centralized controller may be dominated by attackers. An attacker can cause a DDoS attack against the controller by sending a huge amount of malicious traffic to the network [3], [4]. Sudden incoming traffic will not find any match in the Open flow table and trigger an extensive packet_in messages which results in overloading the controller which eventually crashes the controller [5].

Several research works have been done on traffic flow management to overcome bottleneck conditions. [6], [7]. In this paper, we focus on monitoring packet_in rate and packet_out rate, calculate the entropy for every destination address to detect flooding attacks. Our method can detect the DDoS state in the early stage of the attack. Experi-ments verified that this method can efficiently prevent DDoS attack traffic and reduce controller overhead in an SDN environment. Our work is aligned with SDN-enabled infrastructures which support both wired and wireless devices.

The rest of the paper is organized as follows. Section II, briefly describes SDN, Openflow packet_in message. Section III addresses related works to our method. Section IV describes how our packet_in messages detection method works. Section V presents our experiments and results. Finally, Section VI concludes the paper and discusses future work.

BACKGROUND

SDN

SDN is designed to make the network more scalable, flexible, and trouble-free management. SDN adoption is ac-celerating across the data centers, smart grid, and WANs. SDN architecture consists of six elements shown in fig 1: application plane, control plane, data plane, management plane, southbound interface, northbound interface, and

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APIs. There are numerous SDN controllers, namely Ryu, Open Network Operating System(ONOS), Open Day light(ODL), floodlight, NOX [8]. In this paper, we adopted the Ryu controller as an SDN controller. It is written in python. It provides network management and control applications. It supports fully, OpenFlow 1.0, 1.2, 1.3, 1.4, 1.5, and Nicira Extensions [9]. The OpenFlow protocol is used to communicate between the SDN controller and data plane & SDN controller and application plane.

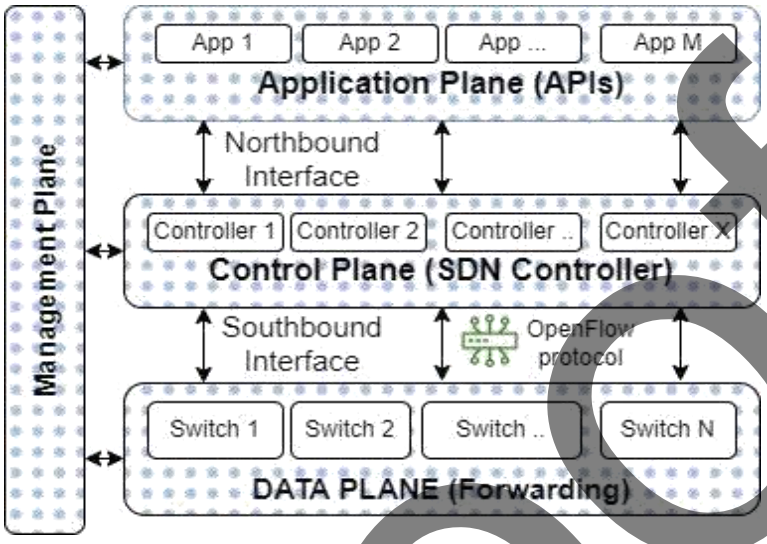

FIGURE 1. SDN Architecture

OPENFLOW PROTOCOL

Openflow protocol is a communication protocol between the SDN controller and the data plane (switches). Openflow is mainly ruled by APIs. In the Ryu framework, the controller sends a feature request to the switch upon session establishment and the switch responds to it with a reply message. Several new OXM fields in Openflow assist in network monitoring, and management [10]. The network can be boot in a reactive or proactive manner i.e stateless or stateful switches. SDN controller fetches the information and changes them into flow entries which are fed into the flow table of switches. Table misses entry can be forwarded to the SDN controller using packet_in messages. Hence if packet_in rate increases table miss entry encounters which will hamper the throughput of the controller. There are many enhancements in OpenFlow 1.5 such as optical port, port change, vacancy eviction, flow monitoring, bundle, scheduled bundles role status of controller packet type, and extensible flow entry statistics [11] in comparison to the previous version of OpenFlow. The egress table is enabled i.e before sending the packet to an output port, the packet should be processed by the egress table. Table status event key OFPT_TABLE_STATUS enabled to get early warning threshold of the flow table. In this paper, the OpenFlow v1.5 protocol with Ryu is chosen as a communication protocol. In Fig. 2 the path of packet_in to packet out from the controller is presented with their structure description.

SDN VULNERABILITIES AND THREATS

SDN features introduced new security challenges with large area of attack surface. SDN is exposed to numerous threats due to its abstraction layer architecture and programmable behaviour which includes application layer, control layer and data layer. Application conflicts, policy rules conflict and malicious code are the major threats in application layer. Centralized controller is high value target for attacker to have overall control of the network.

Programmability feature gives invariable option to the attackers. In data plane switches are vulnerable to flooding attacks. A malicious user can flood the switches with large payloads which exceeds the buffer capability [12].

RELATED WORK

Many studies have been done on balancing the load of SDN controllers using packet_in messages [13]- [14].

In [15] author proposed a packet_in trigger mechanism, feature selection based on correlation coefficient, and SVM to select the best features from multiple features for DDoS detection. The proposed classification recognition

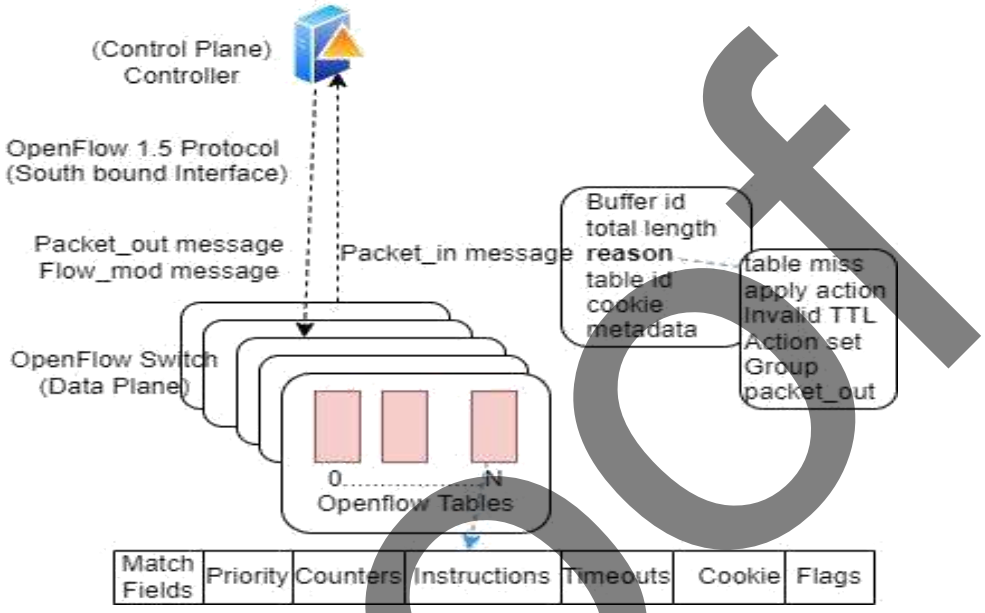

FIGURE 2. The packet_in processing of an SDN controller

method has a low false alarm rate but CPU consumption is high. In [16] author proposed a dynamic trigger method for real-time DDoS detection. The approach consists of three modules (1) Data collection (2)Trigger (3) Detection module. Collecting features from packet_in message and calculating the entropy of individual (IP destination port, IP destination address, and IP source address). The result shows the better efficiency in detecting DDoS using packet_in message overflow entry based. In [17] author worked on minimizing the dropping percentage of packets. The pro-posed approach filters the packet_in message according to the header fields that have already been sent in the packet_in message. Filtered packets are considered as pending rules and stored with idle timeout and hard timeout. Rate control implemented on kernel and userspace process. This mechanism added overhead in terms of rate limitation and exe-cution time but give relaxation on packet_in messages. In [18] author categorized the packet_in messages according to their network control behavior. Forward behavior is not considered a network control. Flow setup and state change packet_in messages have been given more importance. Hence approach limits the bandwidth to the forward type of packet_in message.

PROPOSED SCHEME

In this paper, we propose a DDoS prevention method by monitoring packet_in messages. Many of the research focuses on flow entries in flow tables but very few of them are using packet_in message analysis for prevention or detection [18], [17]. DDoS attacks overwhelm the network's queues or the devices that provide bandwidth. Imagine that several new requests appear simultaneously in the flow table. For all new packets, they do not have a matching

flow entry in the flow table. Hence table miss occurs and the packet sends for a controller action through packet_in messages. This action transfers the control of the packet to the controller. When DDoS occurs the huge amount of packet_in messages get hit which increases the load of the controller suddenly and the controller may get overload soon by packet_in message. Concerning this issue, our approach will minimize the load of the controller by monitoring the packet_in messages.

ARCHITECTURE DESIGN

The approach is divided into three modules packet_in analysis, feature extractor (header), and a prevention module. Experiment done on the Ryu controller with OpenFlow 1.5. when a DDoS attack occurs, the attacker sends packets

TABLE 1. Comparison of packet_IN Analysis and detection parameter considered for using

Ref	Detection Method	Packet_IN Analysis	Parameters	Result
[13]	Information Entropy and CNN	PACKET_IN rate > thr Deep detection Server	port entropy Packet into image	98% accuracy decreases the false alarm rate.
[15]	Protocol based	packet_in rate, threshold set window	SVM trained all flow table entries	DDoS detection rate after feature selection is higher
[16]	Self Organizing Maps exact-STORM	m packets	Entropy of IP source address IP destination address, port	low false rate Keeps record of current and previous
[17]	Protocol based	Filter network control packet_in messages	Pending flow rules flow tables	Minimizes the CPU load
[18]	Filtered packet_in into State Change, Flow Setup, Forward	Overall Bandwidth of packet_in	Pending flow table	minimizes CPU utilization
Our	Information Entropy	PACKET_IN and packet_OUT rate	IP destination entropy	Minimize CPU overload prevention in early DDoS stage

from different locations targeting the same IP address which generates a large amount of Packet-In messages to the controller. Considering these hypotheses we are adopted this design. This design will help the controller to overcome the problem of overloading with minimum overhead in early stage of flooding attacks.

Packet_in Analysis Module This module is used to detect abnormal payloads of packet_in messages using threshold, and time lag between packet_in rate(C_PINR) and packet_out rate(C_POUTR).

1. Evaluate packet_in rate(C_PINR): packet_in messages hit in time interval t (20ms).
2. Compare threshold value with C_PINR.
3. If threshold is greater than C_PINR then calculate the rate of the packet_in message and packet_out message.
4. If (C_PINR > C_POUTR * 1.3) then call Feature Extractor Module.

Feature Extractor Module In this module destination IP address is processed only to keep low computation head and early prevention from DDoS scenario. Low entropy of IP destination indicates focused probability distribution.

1. This module extracts only the destination IP address from the header field of the packet_in message.
2. Calculate the entropy of the IP destination address. Entropy formula is

$$Dc = \sum_{i=1}^{n} P(i)\log_2 P(i) \quad (1)$$

(where n is the number of packet_in messages)

Prevention Module In this module we compare the entropy for each IP address with predefined threshold value.

1. Current entropy (Dc) is compared with the threshold value for each IP address (predefined 0.4).
2. If it exceeds the value of 0.4 indicates low entropy. Send Alert Sign.

Selecting only the IP destination address feature may result in a higher percentage of false-positive but at the time of high payloads. But, this approach helps the controller to process the packets instead of getting into exhaustion state. Only choosing the destination address feature from the packet header will almost eliminate the overhead, time consumption, and supports for taking decision faster when an attack occurs. DDoS attack needs early detection for survival.

EXPERIMENTS

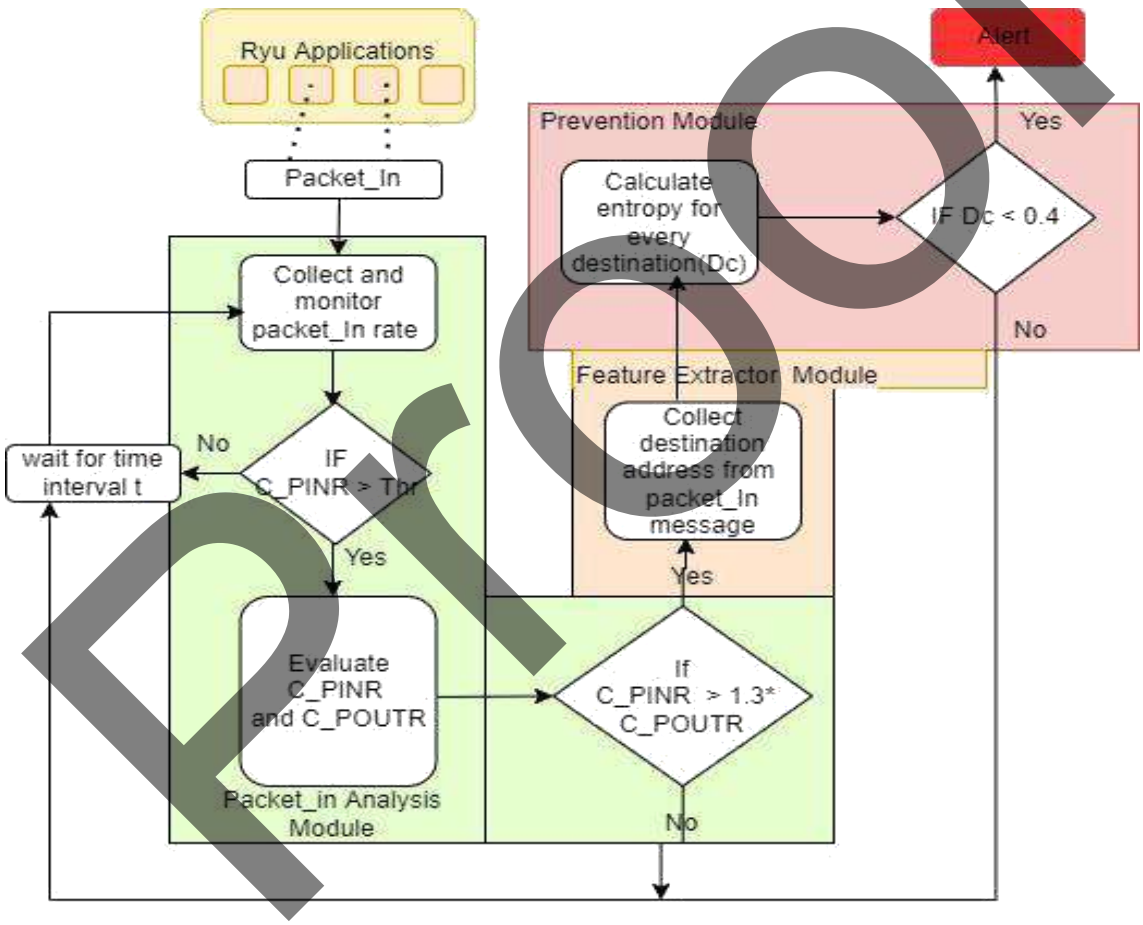

FIGURE 3. Proposed Scheme Flowchart

Algorithm 1 Proposed Scheme Algorithm

```
1: for Every time step t do
2:     Collect Packet_in Rate (C_PINR)
3:     if C_PINR > Thr then
4:         Calculate time lag between C_PINR and C_POUTR
5:         if C_PINR > C_POUTR* 1.3 then
6:             Extract IP destination address from the packet_in message
```

```
 7:              Calculate entropy for each destination (Dc) (Eq.: 1)
 8:              if Dc < 0.4 then
 9:                  Alert
10:              end if
11:          end if
12:      end if
13: end for
```

This section describes the evaluation of the proposed method using Ryu as the SDN controller. Implementation of the proposed method is deployed on the controller using python [9]. The experiment was done in two-phase, first in a normal state and then with simulated attack traffic to observe the packet_in rate. Scapy [19] is used to generate traffic and Wireshark is used for monitoring packet processing.

Steps to calculate the time interval between packet_in and packet_out

1. Start mininet
2. Config a switch with 4/5/6 hosts
3. Start controller then Openflow protocol 1.5
4. Start capturing network
5. Ping to each other
6. Wait till packet_out message receive
7. Stop capturing and measure the time between packet_in(t1) and pack_out(t2) messages.

Steps are repeated by 4-to 6 times to observe the time interval of packet_in rate and packet_out.

Calculated probability for each IP address using the Shannon formula from packet_in message queue is shown in Fig. 4. The lower the entropy higher the distribution feature is visible for the IP address (10.0.0.2).

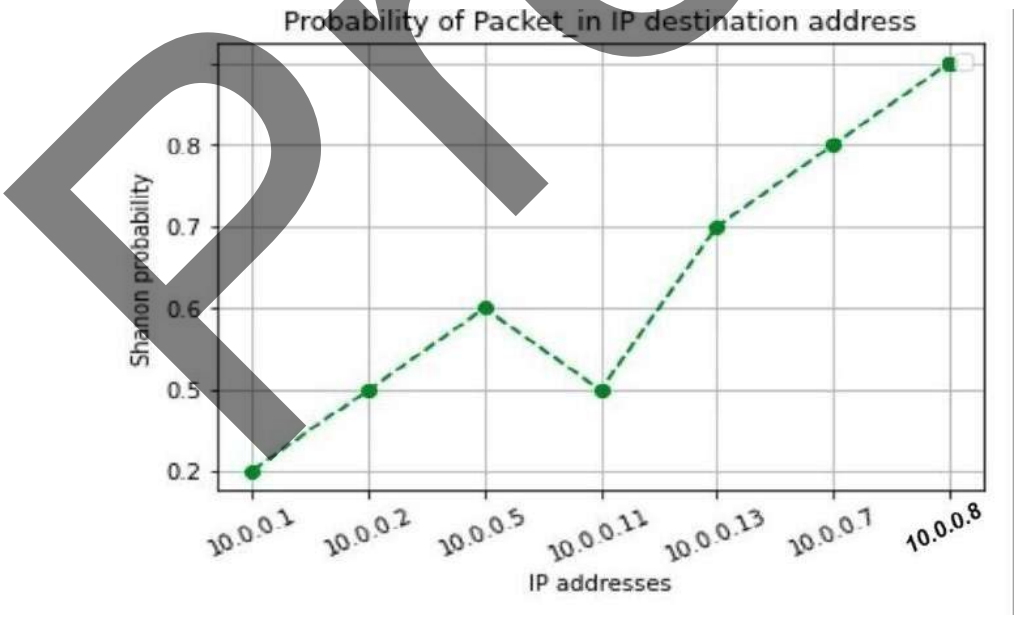

FIGURE 4. Shanon Probability for each IP address

CONCLUSION AND FUTURE WORK

In this paper, we design a flooding attacks prevention system using OpenFlow 1.5 and Ryu controllers in SDN to minimize the risk of controller overload. We propose monitoring the packet_in message rate first and then the interval between packet_in and corresponding packet_out messages to detect attacks. Monitoring Packet_in messages reduces the load of the controller and calculating entropy based on the destination IP address helps in the early detection of the attack. Although the simulation was conducted on a small network but tested 6-7 times with a different number of the host to show that the proposed method reduces the risk of controller overhead and minimizes the overhead time by taking one parameter to prevent a DDoS attack in early stage. The drawback of our proposed system is working with pre-defined threshold values. Future work will provide an efficient mitigation system and dynamic threshold. In the future, a more granular filter can be done by selecting multiple features to prevent or detect DDoS attacks.

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Patient Data Privacy Preservation using Modified Whale Optimization

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Abstract. Due to a lack of standardised electronic medical records, dataset accessibility for algorithms training and testing is limited as well as strong legal and ethical constraints to safeguard medical confidentiality, are currently impeding the widespread use of computational models in medicine. Co - ordinated data interchange In diagnostic imaging, methods such as Digital Image analysis and Transmission in Healthcare and virtual information storage are the workhorse, eliminating the first issue largely, but privacy requirements are as tight. To prevent patients' privacy invasion while promoting scientific study on massive datasets aimed at improving care quality, technical solutions that simultaneously match the needs and desires for data protection and utilisation are necessary. The medical information from the patient is encrypted with the two fish encryption algorithm and stored in the cloud server. The information from the cloud is decoded with the use of a key from the modified whale optimization, as well as the decoded information is categorized with the Random Forests.

INTRODUCTION

Technological advancements have surely improved services in all sectors of the world. Scientifically, information technology has aided crucial health-care breakthroughs. Nonetheless, despite the obvious noticeable effectiveness of e-Health employing Cloud Technology, its complete implementation is limited by vulnerabilities. We apply security methods to secure medical records in this project, and we adopt software products to fulfil the demands of data protection and use at the same time. A patients ' health information is encrypted using the two fish symmetric encryption. The cloud service provider stores the cipher text. The data is analysed after it has been decrypted from the cloud using the key from the whale optimization algorithm. The Random Forest method is used to categorise diseases. The human's heath will be classified as normal or anomalous based on this categorisation.

RECENT AND RELEVANT WORK

Sandeep P. et al [10] goal is to propose a novel architecture for protecting medical information from external dangers while using as few resources as feasible from poor medical equipment.For the training process, this paper proposes an ML-based biometric security framework in which characteristics are derived from electrocardiogram (ECG) data. The suggested methodology offers both scientific and economic value, making it more suitable for real-time healthcare applications.

Aldeen YAAS,et al[4] proposes the development of numerous algorithms to protect privacy of the information to be mined has emerged as an accurate and rapid option for confidentiality data mining. Despite widespread use of the generalised K-anonymizing technique, its protection and honesty efficacy are confined to a small output area, resulting in unacceptable utility loss.We introduce a hybrid K information migration approach that overcomes this constraint by combining L-diversity with (,k)-anonymity. A control input component was the data relocation, which was a compromise between trustworthiness and utility. For data relocation, the effectiveness of each K-anonymity iteration is assessed. To construct anonymizations of fine granularity with ensured privacy standards, data rows are broken down into tiny groupings of indistinguishable tuples. For a modest number of group relocations, the experimental findings showed significant utility increase.

Mohamed Elhoseny et al [7] used the Advanced Encryption Standards to create a hybrid security paradigm for safeguarding diagnostic text data in medical imaging. The suggested model encrypts the confidential message upfront, then hides the findings behind a screen image. The suggested model demonstrated its ability to conceal sensitive

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patient information in a transmitted cover picture having high interpretability, capacity, and minimum stego-image degradation. Deshmukh et al[2] introduces a methodology of storing health records using a two-fold data and key control mechanism. This enables doctors and patients to view their medical records. Hanen, J et al[8] offers a mobile healthcare solution that combines health monitoring with mobile computing. It implements a healthcare system that meets client needs while maintaining professional standards. The cardiovascular failure sign is sent straight to the doctor via mobile utilising a remote protocol.

EXISTING WORK

Technological resources that concurrently satisfy the requirement for data security and use are required to prevent patient privacy infringement whilst boosting research analysis on massive datasets aimed at improving patient care. Everyone becomes a patient at some point, and we all require excellent treatment. We recognize that professionals are professionals and that all of their decisions are based on exhaustive investigation. That cannot be the case all of the time. They can't reasonably remember all of the information, and they can be inaccurate at times.

PROPOSED SYSTEM

To address the shortcomings of the current system, we employ the Random Forest Algorithm, which is a classification technique that analyses the participant's information to determine if the individual is in normal or anomalous state. We collect and process the unencrypted data using a machine learning method. Once the documents have been authorised, verified, and decrypted can the viewer access them. Using two fish encryption algorithms and modified whale optimization, this system is especially economical and robust. The recommended solution's performance is an indicator of correctness, latency, and memory consumption.

ALGORITHM AND MODEL DESCRIPTION

a. TWOFISH ALGORITHM

Bruce Schneider, an American security expert, first released The Twofish in 1998. It's related to AES (Advanced Encryption Standard) and Blowfish, an older block cipher. Twofish was a finalist for becoming the industry standard for encryption, but it was eventually defeated by the current AES. When it comes to encryption techniques, Twofish is thought to be quite safe.

An optimal two-fish encryption approach is used to give encoding in this structure. Two fish is a 128-bit block encryption with variable key lengths. A 16-round Feistel network with an injective F function built of four crucial 8-by-8-bit S containers, a fixed 4-by-4 maximum distance separated matrix over GF(28), a pseudo Hadamard transform, and a fixed 4-by-4 maximum distance separable matrix over GF(28) is used to create the GF (28).

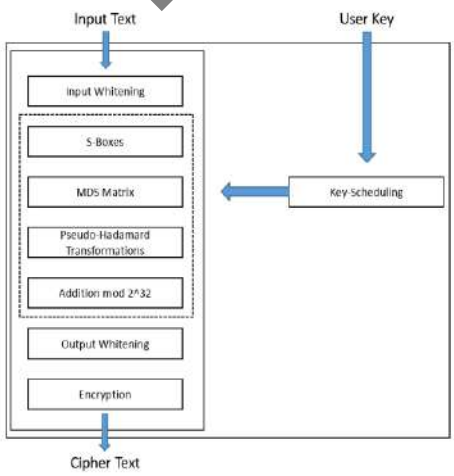

FIGURE 1. PROCESS FLOW OF THE TWO FISH ENCRYPTION

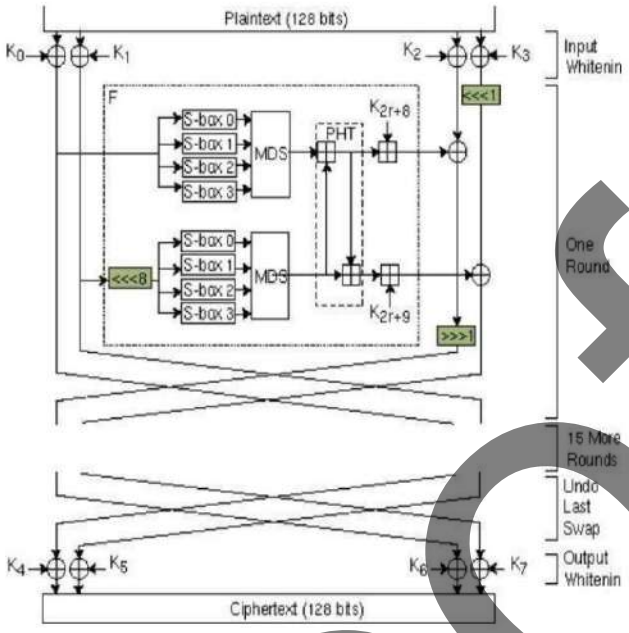

FIGURE 2. TWO FISH ENCRYPTION ALGORITHM

PERFORMANCE OF THE TWOFISH PERFORMANCE

On elevated Computers, Twofish bellows, and it's versatile enough according to minuscule shrewd CPUs. Also it's effective in equipment. It stands out among the AES options due to its outperforms among key lead times and cryptographic performance. Most such cryptographic techniques include a key-setup function, which takes the key and generates the round subkeys that the method requires. Twofish must take the key and create S-boxes and round subkeys that are key dependent. Blowfish, which had been doing the same task, was slow in establishing a key, taking 521 encryptions. Twofish is substantially faster;setting up its keys can take as little

TABLE 1. Two Fish Performance

Processor	Language	Keying Option	Code Size	Clocks to key			Clocks to encrypt		
				128-bit	192-bit	256-bit	128-bit	192-bit	256-bit
Pentium Pro/II	Assembly	Compiled	8800	12600	15300	18000	275	275	275
Pentium Pro/II	Assembly	Full	8350	7700	10600	13400	305	305	305
Pentium Pro/II	Assembly	Partial	10600	4800	7500	10400	450	450	450

Pentium Pro/II	Assembly	Minimal	13500	2300	5200	8100	710	710	710
Pentium Pro/II	Assembly	Zero	9000	1150	1500	1900	850	850	850
Pentium	Assembly	Compiled	8800	24500	26700	28700	280	280	280
Pentium	Assembly	Full	8100	11200	14000	15900	305	305	305
Pentium	Assembly	Partial	10200	5400	7700	9700	420	420	420
Pentium	Assembly	Minimal	12500	3600	5800	7800	730	730	730
Pentium	Assembly	Zero	8600	1700	2000	2500	900	1200	1500

The key may be put up fast, but encoding takes longer; this is appropriate for encoding a sequence of smaller chunks with often varying keys. In assembly code, the table below lists the performance of the existing establishment and encrypting for five inputting choices both on the Pentium II/Pentium Pro as well as Pentium, in clock pulses per frame. Several chips are comparable or superior. The Intel design is by far the most inconvenient and difficult to optimise. It is substantially less expensive to write code that meets these performance metrics on a more general architecture.

All of these alternatives work together; they're simply different implementations of the very Twofish method. Information is protected and retrieved using two primary techniques. Twofish offers a choice of barter when it is associated with smart cards. The table below is based on code developed for the 6805 processor. The Memory predictions are based on the assumption that the key must be present in Random Access Memory. Both the block cipher codes are included in the code size. If only encrypted data is required, the code size and throughput figures improve slightly.

TABLE 2. Whale Optimization Performance

Code and Table Size	**Clocks per block**
2170	29000
2050	32800
1900	34900
1660	37000

WHALE OPTIMIZATION ALGORITHM

The Whale Optimization Algorithm (WOA) is a new contemporary economical environmental technique that replicates giant whales' community action when chasing their aim. WOA employs the aforesaid humpback whale methods:

SURROUNDING THE SUBJECT

Bubble-net assaults identify and surround the point of the best solution found (key). Once the leading search agent has been discovered, the other search agents seek to revise their positions further toward the top search agent. Humpback whales have the ability to identify prey and encircle it. In the WOA method, the current best candidate solution for the undetermined position of the optimal design in the problem space is the target prey or is satisfactory. Once a best search agent has been identified, the remaining search agents will attempt to change their locations in order to align with the best solution.

The updated method is:

$$D = |C \cdot S^*(i)| \cdot S(i+1) = S^*(i) - V \cdot Di$$

The vectors V and C are compared as follows: 0

$$V = 2ar - a$$

a - current iteration
V - Coefficient Vector
C - Coefficient Vector
S^* - Position vector for best solution obtained for far
S - Position Vector
| | - absolute value

In both the exploration and exploitation stages, a is linearly lowered from 2 to 0 over the course of iterations, while r is a random vector (0, 1).

BUBBLE-NET ATTACKING

SHRINKING ENCIRCLING MECHANISM

Reduces the search agent's range to the top search agent's location and surrounds them. A search agent's novel position can be found anywhere (within this limited range of circle) between both the agent's initial place and the current best agent's position.

SPIRAL UPDATING MECHANISM

The search agent looks again for keys within the diminishing circle, similar to how humpback whales swim around their prey in a spiral-shaped pattern within the reducing circle. Humpback whales can really detect their prey's location and hunt it in a diminishing circle. Because the optimal solution to the optimization issue is unknown initially, WOA assumes that the best current optimal approach is the prey or near to it.. Other search agents are attempting to improve their positions in order to compete with the best search agent. To model the tactic of surrounding the prey, apply the following mathematical equations:

$$D = |C \cdot B - x^t|$$

$$x^{t+1} = B - A \cdot D$$

$$A = 2a \cdot r - a$$

$$C = 2 \cdot r$$

D′ is indeed the exact measure of the range between both the actual search agent and also the best search agent at iteration t, and b is a constant that specifies the form of both the logarithmic spiral. l is an irregular number between 1 and 1. As humpback whales travel in a diminishing circle and along a spiral-shaped course, WOA executes the two behaviours (diminishing circles and circular pattern movement) with a 50 percent chance of occurring.:

$$x^{t+1} = \begin{cases} B - A.D & p < 0.5 \\ D^t.e^{bl}.cos\,(2\Pi l) + B & p \geq 0.5 \end{cases}$$

SEARCHING FOR PREY (EXPLORATION PHASE)

To find the best search agent, the same technique is employed (key). A is utilised with a random number greater than 1 or even less than 1 to replicate the humpback whales' random quest for prey. Exploring is accomplished by the use of a random search agent, whereas exploiting is accomplished with the use of the best search agent, as in the bubble-net technique. The hunting for prey may be described numerically as:

$$D = |C \cdot x_{rand} - x^t|$$

$$x^{t+1} = x_{rand} - A \cdot D$$

RESULTS

Encrypt, decrypt, upload, and categorization are the four modules. Choose one healthcare data - set data file and click on Encrypt option after selecting the Encrypt button. The medical information will be password-protected. Insert the encoded information to the databases using the upload button. Choose one healthcare data - set which is already encoded and pick the decrypt option when you click the Decrypt button. Decryption of the data set will take place. The information will be categorized using the categorization button depending on the illness and its characteristics.

CONCLUSION AND FUTURE WORK

As a result, the suggested system employs the Modified Whale Optimization method to find the best key, the two fish encryption technique to encode the health information, and the Random Forest algorithm to categorise the files and safely store them in the cloud. These encryptions are frequently recovered employing the best key inside the decoded format, protecting the patient's health records.

FUTURE WORK

The model's complexity must be raised, making new models more difficult to comprehend and evaluate as their complexity grows. By modelling multiple approaches and eventually supporting decision-making and planning strategies, various methodologies must be employed to tackle the challenge of balancing security and privacy models. Conventional encryptions such as DES do not allow any operation other than secure storage, while the emerging Encryption Algorithms allow secure data sharing based on the credentials of the sharing parties. Working with the upcoming modified encryption algorithms will help in protecting the medical data securely.

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Challenges and Issues Analysis in Cold Start Recommendation System

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Abstract. Users frequently receive recommendations from recommender systems based on their taste, need and/or preferences. Recommender systems have shown to be an effective technique to combat information overload due to the ever-growing number of information available online. Given its potential to help resolve numerous over-choice issues, the use of recommender systems cannot be emphasized. There are many distinct kinds of recommendation systems, each with its own principles and methodology. Recommendation systems have been implemented by many applications, including those in different business areas i.e. online e-commerce websites, heal sector, tour and travels and transportation system, agricultural segments, online music, movie and other media as well. This research paper focus on the avant-garde in recommender systems and pinpoints to future prospects for a number of applications. A qualitative evaluation methodology and recommendation architecture is used to judge a recommendation system's quality. We have identified lots of machine learning ideology and according to ideology based architecture we find the accuracy degree and recommendation engine execution time span perfectly.

INTRODUCTION

With the growth of the internet and contemporary web services over the past few decades, everyone today has access to an abundance of information. Users may find it difficult to sort through all of this data and extract the most important elements. With millions of products available on one platform, many online e-commerce companies propose products to their customers. The sheer number of options available to the average user can be daunting, leading to information overload. By providing users with precise, individualized recommendations of items or products based on their tastes, recommender systems try to address the issue of information overload while also personalizing the user experience. Based on the information provided, a recommendation system (RS) seeks to determine if a product would be valuable to a user. These systems are utilized by retail and e-commerce companies like eBay and Amazon, as well as in other sectors like agriculture, event management, transportation, education, healthcare, insurance [26] and their use has been rapidly expanding over the last few years. These businesses gather a huge amount of user data and modify the Recommendation system to fit both user and company requirements. High-quality Recommendation system have a positive effect on users' experiences as well as the overall decision or revenue of organizations. In recent years, recommendation system have drawn the attention of numerous researchers, and numerous literature evaluations have been undertaken to examine the features, problems, and algorithms of various recommendation system[1]. However, none of these assessments comprehensively covered every aspect of recommendation system. In, authors concentrated on classifying recommendation system based on the data they used. In addition to location-based recommendation system utilizing social networks, a survey of recommendation system using only social networks is also available. From the perspective of their applications, recommendation system are surveyed. A review in has concentrated on recommendation system' algorithms while summarizing their properties [2].

In this article, an in-depth introduction to recommendation system has been provided, also describe many recommendation system categories and examine problems with existing recommendation system, such as cold start, data sparsity, scalability, and variety. Additionally, we show how to assess the recommendation system' effectiveness using various metrics, including recall, precision, accuracy, the *Receiver Operating Characteristic* curve, and *F-measures*. We also describe the widespread use of recommendation system in various fields and sectors. The recommender does not work with raw profile data. Creating a meta-level hybrid from any given pair of recommenders is not necessarily simple. Because the contributing recommender must develop a model that will be utilized as input by the real recommender, not all recommendation algorithms can do this. The learnt model suggests a compact representation of the user's desire, which is an advantage of this method. Dealing with this condensed form is easier than working with raw rating data in a collaborative method [8], [22]. A system that produces individualized recommendations as output or has the effect of guiding the user in a personalized way to interesting objects in a larger space of possible options. Recommender system will become an integral part of the Media and Entertainment industry in the near future and it became a wonderful background of any industry power [fig.1]

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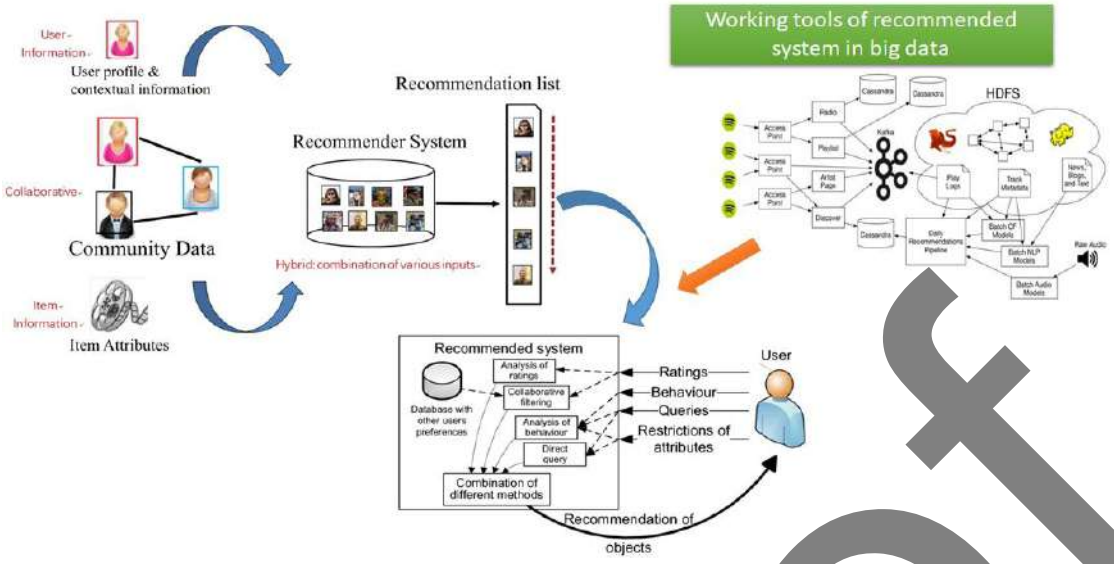

FIGURE 1. Big data relative Recommendation Models or architecture

REVIEW OF CATEGORIES OF RECOMMENDATION SYSTEM

Recommendation system is categorized into six most popular subsets, which are:

- Content based recommendation system
- Collaborative filtering recommendation system
- Utility based recommendation system
- Demographic based recommendation system
- Knowledge based recommendation system
- Hybrid based recommendation system
- Context-Aware recommendation system

A comprehensive review of these categories is:

CONTENT BASED RECOMMENDATION SYSTEM

Content-based strategies aim to create a user profile to forecast ratings for items that have not yet been seen. Tags and keywords are used in productive content-based techniques. Recommendations in content-based filtering are influenced by the users' prior decisions. Content-based filtering heavily relies on item descriptions and user orientation profiles. Content-based filtering algorithms attempt to suggest products based on the number of similarities. Heuristic functions like the cosine similarity metric are frequently used in the calculation of content-based filtering utility. In many situations when it is simple to extract the values from the features, content-based filtering can be used. When features values must be manually input, content-based filtering is often not employed. Small datasets can make this doable, but when hundreds of new goods are being added every day, it becomes hard to complete the work. These methods enable the system to scale up and accommodate numerous users. Since this system simply needs to analyze the items and user profile for suggestions, content-based filtering is user-independent. Contrary to collaborative filtering, content-based filtering has no problems getting started after a cold start. Before a sizable number of consumers rate an item or product, new suggestions are made. Filtering based on content has a number of issues. First off, the suggestion won't be correct if there isn't enough detail in the text to clearly distinguish between goods. These methods demand in-depth subject-matter expertise. Second, because they have to match the features of objects and profiles, content-based solutions only provide a small amount of innovation [3], [4].

COLLABORATIVE FILTERING RECOMMENDATION SYSTEM

Collaborative filtering analyses historical data to rate products based on explicit or implicit user evaluations. It operates by creating a database of the user's product preferences. In order to identify active users' neighbors who

have similar purchasing interests, active users will be mapped against this information. *Item-based filtering* and *user-based filtering* are two categories for collaborative filtering strategies. In order to predict an individual user's rating of an item, user-based approaches go through two primary steps. The initial step is to find people who are comparable to the target user. The second stage collects ratings from users who are comparable to the current user and uses them to generate suggestions. Each active user receives a recommendation by comparing their preferences to those of other users who've already rated the product similarly to them.

There are several collaborative filtering algorithms that calculate users' similarity. Mean-squared difference, Pearson correlation, cosine similarity, Spearman correlation, and modified cosine similarity are some of the regularly used similarity metrics in the literature [3]. The most popular option for recommendation system is collaborative filtering [20], which does not require domain expertise because the embedding are automatically taught. Mapping objects to a series of numbers is referred to as embedding items in a recommender system, some of them provide the contrastive learning based recommendations to solve the cold start problem [23]. Algorithms are trained to discover relationships between things and extract their characteristics using this method of describing items using learnt vectors. The generation of models by collaborative filtering also aids users in discovering new interests, which is another benefit. Last but not least, collaborative filtering is an excellent place for other Recommendation system to start because it simply needs the rating matrix R to create a factorization model. Each element in this matrix, rij, reflects the rating given by user i to item j. The rating matrix R is a two-dimensional matrix comprising n users and m things. Collaborative filtering is advantageous in many ways, but it also has certain drawbacks, such as the cold-start issue, which is covered in more detail in Section 3.5 of this study. Some popular strategies have been implemented recently like semi-personalized recommendation strategy [18].

SOCIAL MEDIA RECOMMENDATION SYSTEM

This type of system offers recommendations based on the user's relationships with their friends in social networks, and sometimes this recommendation also depends on the value of user trust in each of his friends [Figure 2] Instagram, YouTube, TikTok, Snapchat, Facebook, Pinterest, LinkedIn, Twitter are uses different recommendation system for improving better ranking and promotion. Dot size define the accuracy or network between different members show in figure 2 .The basic idea through which social models would be exploited in information filtering systems would be to drive traditional community formation based on votes, through social media e.g. friends are connected to their friends, and friend's friends as well. Compared the classic collaborative recommendations with those made by friends on three movie and/or book recommendation systems e.g. Rating Zone, Reel.com, Amazon.com, Movie Critic, Sleeper etc. The results showed that users preferred those made by their friends. This can be explained by the fact that the friends are more qualified to advise them since they are supposed to know more about the preferences of the users [21], [24].

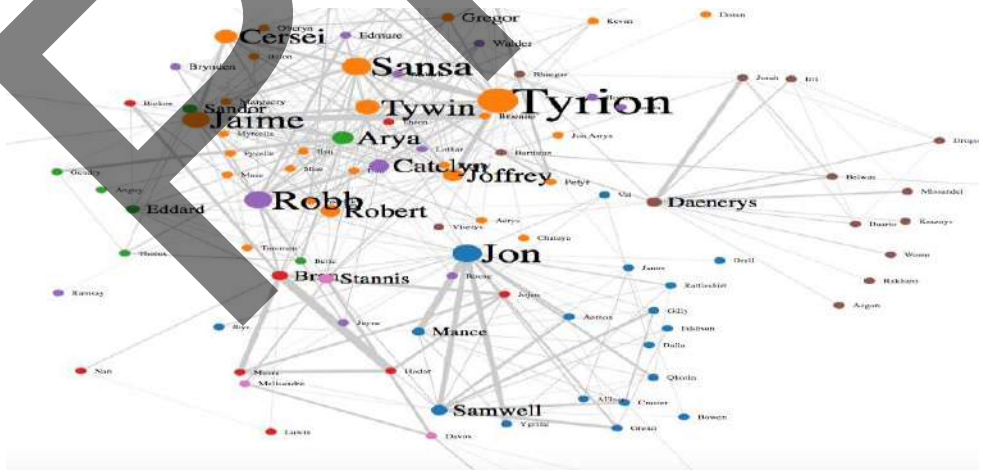

FIGURE 2. User preferences based Social Network

UTILITY BASED RECOMMENDATION SYSTEM

Utility-based recommendation system generates a utility model of each item for the user before making suggestions. Based on the explicit calculation of each item's user-utility, this approach constructs multi-attribute users'

utility functions and suggests the greatest utility item. Utility-based recommendation system are helpful because they may incorporate non-product variables like product availability and vendor dependability into utility functions. They produce utility computations that enable them to examine an item's characteristics and real-time inventory. It allows the user to see its status visually. Utility-based systems don't retain broad generalizations about their customers over the long term. Instead, they assess a suggestion in light of the user's present requirements and the alternatives. The utility-based method has issues when the goods are not sufficiently descriptive. Because there aren't enough utility characteristics offered, a recommendation to a user can go unnoticed even if it matches their tastes [5].

DEMOGRAPHIC BASED RECOMMENDATION SYSTEM

By classifying users according to demographic parameters, demographic recommendation system can produce suggestions. Particularly when there is a dearth of product information, demographic recommendation system are helpful. Scalability and cold-start issues are the focus of demographic recommendation system. To provide suggestions, this system uses user attributes like demographic data or recommendations made via demographic filtering are based on the user's demographic profile. Here, the user's information is used to make recommendations that are thought to be similar based on demographic factors like nationality, age, gender, language, etc. [6]. The main benefit of demographic filtering recommendation system is how quickly and simply they may produce conclusions from a small number of data. Additionally, these methods don't gather the user ratings required for content-based and collaborative-based filtering methods. Techniques for demographic-based filtering have a number of drawbacks. For instance, given the security and privacy concerns raised, the entire process of collecting user information is unworkable. Second, because user interests are the primary basis for demographic filtering, the algorithm is compelled to propose the same item to users with similar demographic profiles. The stability vs. plasticity dilemma, which refers to the difficulty of changing a client profile as preferences change, is another obstacle.

KNOWLEDGE BASED RECOMMENDATION SYSTEM

Knowledge-based recommendation system develops a knowledge-based criteria to provide recommendations by using explicit knowledge about items and consumers. A knowledge-based recommendation system doesn't need a lot of early data because its suggestions are not reliant on user ratings. By assessing the goods that satisfy the user's demands, it makes recommendations based on their preferences. There are a number of advantages for knowledge-based recommendation system. They can, for instance, avoid the ramp-up issue common to methods to recommendations using machine learning. Exemplary systems often can't learn until the user has rated a large number of objects. Knowledge-based recommendation system do not have this problem because their suggestions are not based on user ratings. Additionally, because the recommendations are not based on a specific user's preferences, they do not need to collect information about that person. These reasons make knowledge-based systems desirable as standalone systems and are also why they are viewed as an addition to other kinds of recommendation system. The possible knowledge acquisition bottleneck brought on by explicitly stating recommended knowledge is one of the main drawbacks of knowledge-based recommendation system. By acquiring information through rules, objects, and frame-based ontologies, knowledge acquisition is the process of creating the rules and requirements necessary for a knowledge-based system. The direction of the process of additional learning and knowledge acquisition was provided by Batesonian ideas [7].

ONTOLOGY-BASED RECOMMENDER SYSTEM

Ontology-based recommender systems employ ontologies to describe knowledge and are based on knowledge. An explicit formal statement of a common idea is an ontology. Modeling the knowledge about the learner and the learning materials makes use of ontologies e.g. in learning type recommender system. Unlike other traditional recommender systems, ontology-based recommenders do not have issues with cold-start and rating sparsity. This is because, in contrast to conventional recommender systems, ontology-based recommenders place a greater emphasis on domain expertise and user ratings. Ontology-based recommenders are more suitable for many learning domains as a result of these advantages. The drawback, however, is that building ontologies is difficult, costly, and time-consuming [19].

HYBRID BASED RECOMMENDATION SYSTEM

To improve performance, hybrid systems [fig. 3] combine two or more strategies. Their major goal is to reduce the disadvantages of the individual ones. The next sections will go over some of the combination tactics. We cover seven key features in the hybrid-based recommendation system, which are as follows [table 1]:

- Weighted
- Switching
- Mixed
- Feature combination
- Cascade
- Feature augmentation
- Meta level

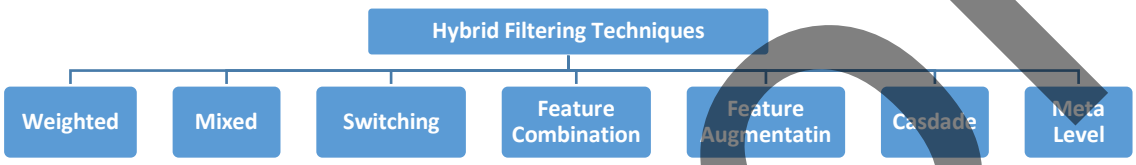

FIGURE 3. Hybrid filtering techniques

WEIGHTED

The weighted-hybrid recommender averages the results of all combined recommendation algorithms before calculating the score of the suggested element. The approach of linear combination of several suggestion ratings is applied. Systems first offer equal weight to all recommenders, then gradually modify the weighting when predictions of user ratings are validated or not. However, this approach implicitly presupposes that the relative worth of individual procedures is uniform among potential objects, which is not necessarily the real [8].

SWITCHING

A switching technique chooses one of the elements as a recommender. Another system may be chosen for a separate user/profile. If the content-based strategy, for example, cannot generate an accurate suggestion with high confidence, another way, such as the collaborative procedure, is tried. This solution does not eliminate all of the disadvantages that recommendation system face i.e., the ramp-up problem. This hybridization approach presupposes a valid criterion for making the switching choice. The remaining unchosen components have no part in the left suggestion process once the switching choice is made [8].

MIXED

When several suggestions are required at the same time, a mixed hybrid strategy is viable. The mixed hybrid technique displays suggestions from its components in a consolidated list side by side. This hybridization strategy does not attempt to pool evidence from different recommenders. Combining many separate lists is a difficult procedure with this strategy. Standard strategies include merging based on expected rating or recommender confidence [8].

FEATURE COMBINATION

Feature combination permits the incorporation of complementing information from one strategy, such as a collaborative-based suggestion, into an algorithm designed to analyze data using another method i.e. content-based

recommendation. Content-collaborative merging is accomplished by treating collaborative information as an extra feature data related to each model and employing content-based approaches across this accumulated dataset. This method allows the system to examine collective data without completely depending on it, which reduces the system's sensitivity to the number of users that rated an item.

CASCADE

The cascade approach is a structured procedure used to create a strictly hierarchical hybrid in which a weak technique with a low priority cannot cancel the judgments made by a higher priority or stronger one, but rather can enhance them. The lower priority recommender is used to break ties between the stronger and higher priority ones in the score. The lower priority strategy is not employed on things that are already well-differentiated by the first. It is also not utilized on the low-rated products, therefore they are not advised. The cascade approach is resistant to noise in the functioning of the low priority technique since ratings can only be enhanced, not reversed [8].

FEATURE AUGMENTATION

It is a comparatively recent technology that is appealing due to the possibility of improving the efficiency of the primary systems. In feature augmentation, a rating or categorization of an object is created using one method, and that data is then included through into processing of the subsequent recommendation method. Intermediaries with the ability to enhance the data with other methods can add extra functionalities. The key advantage of this approach is that it permits the recommendation engine to mix two independent types of recommender systems such that the output of the first is fed into the input of the second and data filters can be applied on a need basis [8].

META LEVEL

The meta-level hybrid employs an output model that is trained by a recommender and then utilized as an input by another. This is not the same as feature augmentation. A feature augmentation hybrid employs the general features of a learnt model as input for a second one, whereas a Meta level hybrid uses the complete learned model as input.

TABLE 1. Methods and Description of Hybrid Filtering

Hybridization Method	**Description of the Method**
Weighted	To create a single suggestion, the results/votes of many recommendation algorithms are merged.
Switching	Depending on the scenario, the system shifts between several types of recommendations.
Mixed	Recommendations are delivered simultaneously from a variety of recommenders.
Feature Combination	A single recommendation algorithm is created by combining features from many recommendation data sources.
Cascade	to design a strictly hierarchical hybrid where decisions made by a stronger or higher priority technique cannot be overruled by a weaker or lower priority approach
Feature Augmentation	An input characteristic from one approach is employed as the output in another.
Meta Level	One recommender's model is sent into another's as input.

CONTEXT-AWARE RECOMMENDATION SYSTEM

Context-aware recommender systems employ data about the circumstances the target user is experiencing to produce recommendations that are more precise. This powerful recommendation system was proposed to choose the item as per the circumstances instantly arises for user. Context-Aware Recommender Systems (CARS) are currently

being used to provide better-personalized user recommendations by leveraging contextual information in addition to traditional two-dimensional search algorithms. It was developed as two-dimension process for providing the better personalization recommendation. Context-aware recommender systems make advantage of dynamic scenario/context information like users' changing behavior, conditions of weather which are changing dynamically, constantly changing government policies, and cultural behavioral traditions/norms in novel ways. It has been demonstrated that adding context information is highly beneficial to nearly all types of recommender systems and speeds up the recommending process. [9], [22].

The term context is defined as: "***Context is any information that can be used to characterize the situation of an entity. An entity can be a person, a place, or an object that is considered relevant to the interaction between a user and an application, including the user himself/herself and the applications themselves***."[10]

MAJOR CONTEMPORARY CHALLENGES IN RECOMMENDATION SYSTEM

The organization's shifting requirements for utilizing and deploying Recommendation system make it difficult to gauge their success. User satisfaction is often the most representative metric. Even if a heuristic method cannot be used to calculate users' pleasure, we may still assess how well recommendation system perform by looking at how effectively they can manage frequent problems.

This section of the review article describes how metrics are used to determine how well a recommendation system works with respect to key problems, which are:

- Diversity
- Accuracy
- Scalability
- Data sparsity
- Threat of potential attack
- Cold start problem
- Habituation effect

DIVERSITY

Recommendation algorithms may offer options for more distinct or similar things depending on the situation. At the same time, recommendations based on user or object similarities get the most precise results. The diversity issue occurs when suggestions are centered on similarities rather than differences. As a result, the consumer is exposed to a smaller variety of products, and highly relevant specialized items could go unnoticed. The variety of recommendations enables consumers to find items that they would not easily find on their own. One obvious worry is that accuracy would be compromised if an algorithm concentrated solely on increasing diversity. Two criteria, surprise and personalization, can be used to assess a recommendation system variety. The recommendation system capacity to produce unanticipated outcomes is evaluated using self-information measurement, which correlate an item's unexpectedness with its level of worldwide popularity. Inter-user diversity, sometimes referred to as personalization, is the distinction between various users' suggestion lists, and it is simple to determine using the inter-list distance. To solve diversity concerns while preserving item recommendations, the accuracy criterion must be kept. Overconcentration occurs when the recommendation system is unduly fixated on precision. By identifying effective frequent item-sets, the Linear Time Closed-item-set Miner (LCM) can boost variety.

Recommender systems are supposed to increase diversity because they help us identify new items. Certain algorithms may inadvertently perform the opposite. In this case, the recommender system proposes popular and highly rated products that a given consumer appreciates. As a result, the accuracy of the suggestion process reduced. To address this issue, new hybrid solutions that improve the effectiveness of the recommendation process must be developed.

ACCURACY

Recommender systems that emphasize accuracy will naturally favor those things which are at the top of a list since accuracy relates to the status of the recommender system's ability to forecast the items that have previously been evaluated by users or interacted with in the system. However, it is quite challenging to determine a recommendation system's 100 percent accuracy in a cold start event. Companies have made several attempts to create algorithms that are precise enough to manage challenges/obstacles likely to be faced by goods, users with lower ratings, or users who are not participating in the system.

SCALABILITY

The rapid expansion of e-commerce websites has significantly increased the problems associated with scalability. For complex applications, modern recommendation system methodologies are needed to produce quick results. Recommendation system are able to search for a huge number of possible neighbors in real-time, but the requirements of contemporary e-commerce sites force them to seek for more neighbors. Performance problems also arise for algorithms when dealing with information consumers that have a lot of data. Finding a pertinent neighbor for a certain neighbor, for instance, might be challenging and time-consuming if a site contains tens of thousands of data points for one user. The vast rise in users or goods necessitates an increase in compute capacity for nearest-neighbor techniques-based filtering algorithms. Scalability is a major problem for a platform that has millions of users and goods. Utilizing one-dimensionality reduction is a frequent method for reducing scalability problems. Scalability problems can be reduced by using clustering techniques. Their main job is to utilize a clustering technique to divide up the user base into neighborhoods. The neighborhood of any active user is then determined by peering inside the partition, which serves as the user's neighborhood. Once the neighborhood has been chosen, a forecast may be made using conventional filtering procedures. The use of clustering algorithms has two important advantages. First of all, it reduces the data set's sparsity. Second, it separates the data into smaller chunks, which greatly slows down the rate of prediction production. The scalability issue has also been minimized using Singular Value Decomposition (SVD). For dimensionality reduction, SVD is employed. A group of uncorrelated eigenvectors/latent-vectors are produced by SVD. Each individual eigenvector serves to represent a customer or product. By using this method, the same eigenvectors may map consumers who have rated goods that are similar but not identical. Predictions may be produced by computing the cosine similarity (dot product) between n-pseudo customers and n-pseudo products after the n m rating matrix is broken down into SVD component matrices.

DATA SPARSITY

Many recommender systems are being used more frequently these days. Several commercial recommender systems make advantage of large datasets. Because the user-item matrix used for filtering is too large and sparse, the performance of the recommendation process may suffer. The primary reason of the cold start problem is data scarcity. Because consumers only plan to rate a small number of objects, data is sparse. Despite the fact that the majority of recommendation system combine similar users' evaluations, the reported user-item matrix comprises empty or unknown ratings due to a lack of incentives or user knowledge to rate things. Since they don't provide comments or ratings, recommendation systems may provide nonsensical suggestions to such users. Assume, for instance, that an online retailer has a large number of users and sells one million distinct movies which may be rated (active) or not rated/liked considering as cold. In this case, each client is characterized by a feature matrix with one million integer elements, where each element's value represents the customer's rating of a particular movie.

The consumer-product interaction matrix is what is known as this matrix. The majority of large-scale applications involve massive quantities of both users and items, the matrix elements will be more than 99%, whilst the average will be 0. At the moment of comparison, there is a good chance that both entries will be zero for all two users, producing a sparse matrix. Several approaches aim to solve the issue of data sparsity by simulating users' choices based on their behavior and trustworthy social connectivity e.g. matrix factorization [25]. The resilience of recommendation system has greatly benefited by the extensive usage of trust. Trust is defined as the confidence in another person's capacity to offer reliable explicit/implicit ratings. By counting the number of arcs that link the users, the trust value may be computed. This offers a trust aware recommendation system that depends on a trusted web network to specify how a user can trust another user. A trust network is built by combining each trust declaration. In a trust network, nodes and directed edges represent users and trust claims, respectively. Because of these strategies, the mean error of anticipated accuracy has significantly lowered. The merge strategy has received attention among the several trust-based strategies that have been proposed. To improve the overall predictive accuracy of recommendation system, the merge includes the trusted neighbors of the active users. According to the similarity between the active user and trusted neighbor, the ratings of a trusted neighbor of an active user are specifically combined by averaging on frequently rated items.

THREAT OF POTENTIAL ATTACK

Every system that is installed on the internet must address the issue of security. Recommender systems are crucial to e-commerce applications, hence it is likely that malicious activities to encourage or forbid specific products may target them. One of the main difficulties facing the recommender system's development is this. The term *Attack* refers to the unethical activity to insert the exaggerated data by fraudulent users which is hard to stop/control in any recommendation system. Even the attackers may attack to recommendation system with specific domain expertise. When creating attack profiles, attackers need to take into account two things. The first refers to choosing the objects from which the profiles are built, and the second involves assessing the items after they have been chosen. Considered are two attack types: *product push* and *product nuke*. The goals of these attacks are to favorably or unfavorably influence the forecasts made for the targeted products/items. The attacker generates a user profile for each of the several identities they take within the system under assault. These profiles are referred to as attack profiles. This is how attack data is added to a system; no further access to the database of a system is anticipated.

Attack Strategies are classified into three types [11]:

- *Popular Attack Strategy*
- *Probe Attack Strategy*
- *Rating Strategy*

COLD START PROBLEM

A recommendation system does not operate at its best when there is inadequate information or metadata provided. Product cold starts and user cold starts are two separate subcategories of cold starts. There are no reviews because of the absence of user involvement when a new product is first presented on an e-commerce website since it goes through the product cold start. The recommendation system won't know when to show the ad for that product if there aren't enough user interactions. When a person establishes an account for the first time without any prior product preferences or purchase history on which to base suggestions, this behavior is known as "cold-start." Both new and seasoned users experience the cold start issue. What should the recommendation system show if, for instance, John looks for new refrigerators on an e-commerce site, buys one within a week, and then decides he no longer wants to buy refrigerator? Users will always be drawn to fresh and novel ideas. When measuring and analyzing cold-start suggestions, we discover that the Bayes classifier is most frequently applied. Graphical models known as Bayesian models are utilized in artificial intelligence and probability.

Whether it is collaborative or content-based, Bayesian reasoning is likely to be used in model-based recommendation system. The naive Bayes model is the most often used application of Bayesian models. Even though it is straightforward, it has shown out to be the most accurate. Different attributes are thought to represent mutually independent properties of the objects in the naive Bayes classification [12]. By using a set of qualities not included in the training data, one may estimate the properties of a new object using this method [13]. Heuristics and the projection in Weighted Alternating Least Squares are employed to some extent to alleviate the cold-start issue. If there is a new item for the projection in the Weighted Alternating Least Squares technique that was not encountered in training but the system has a limited number of user interactions, it is simple to compute the user's embedding for this item without having to retrain the entire model [Eq. 1].

$$min_{ui0 \in R^d} \| A_{i0} - u_{i0} V^T \| \quad (1)$$

Weighted Alternating Least Squares technique, where the system solves for the embedding of the new item while maintaining the accuracy of the user's embedding [Eq.1]. This procedure may be repeated for a new user to keep the model current. If the system has no interactions, the embedding produced by heuristic approaches for fresh objects can be approximated. By averaging the item's embedding in the same category, this is finished.

HABITUATION EFFECT

Recommendation interfaces are regarded as a crucial component of marketing plans and may be used to distribute marketing material. The amount of suggestions, pictures of the suggested item, item descriptions, and layouts are only a few of the components that may be investigated in order to improve the performance of the interface. Customers are frequently exposed to vast amounts of information, particularly marketing content, which often results in the habituation effect, which leads to the issue of banner blindness. Thus, unless they are presented to the user in a better way, recommendations that are ideal from the computational standpoint may nevertheless provide erroneous

outcomes. Marketers typically employ strategies centered on boosting the visual intensity of offered objects by employing animations and flickering effects. The habituation effect can be best mitigated by using MCDA (Multi-criteria Decision Analysis) of features of suggesting interfaces taking into account their visual intensity, attention represented by fixations measured with eye-tracking, and time required to attract attention after a website is loaded.

EVALUATION METHODOLOGY USED IN RECOMMENDATION SYSTEM FOR COLD START PROBLEMS

A recommendation system does not operate at its best when there is inadequate information or metadata provided. Product cold starts and user cold starts are two separate subcategories of cold starts [fig.4]. There are no reviews because of the absence of user involvement when a new product is first presented on an e-commerce website since it goes through the product cold start. Recommender systems are defined as recommendation inputs given by the people or users, which the system then aggregates or predicted values and directs to appropriate recipients. A system that produces individualized recommendations as output or has the effect of guiding the user in a personalized way to interesting objects in a larger space of possible options so Recommender system will become an integral part of the Media and Entertainment industry in the near future due to increasing industry power boosting.

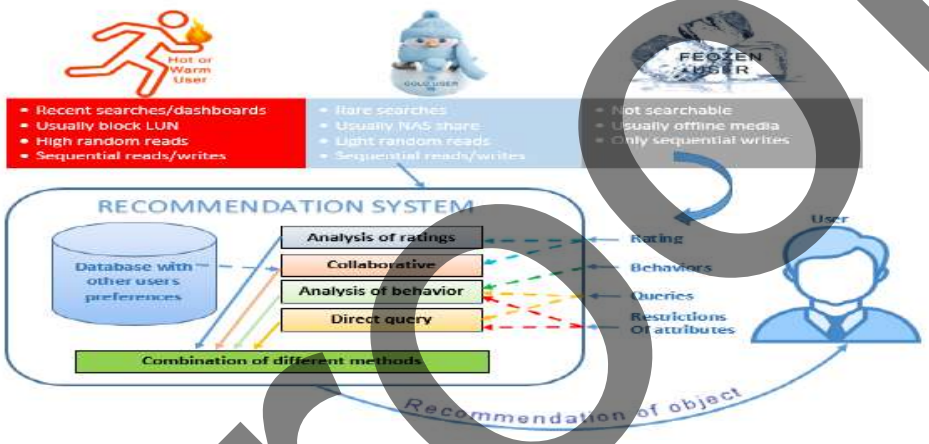

FIGURE 4. Cold start issues and role of Recommendation system

TABLE 2. Groups based degree analysis

groups	precision	recall	f-1
a	0.75	0.81	0.76
b	0.76	0.72	0.74
c	0.89	0.85	0.82
d	0.93	0.96	0.92
e	0.75	0.82	0.76
f	0.86	0.89	0.85
i	0.85	0.88	0.86
j	0.94	0.97	0.92
k	0.75	0.61	0.68

The rating matrix of a dataset is divided into a training set and a test set for the purpose of evaluating the recommendation models. The query set and the target set, which are both the same size as the test set, are then separated. The target set, however, only includes the remaining ratings for each user, whereas the query set only includes the randomly chosen provided known ratings [table 2]. The target set is used to assess the suggested outcomes whereas the query set, training set, and training set are utilized to forecast recommendations [14].

Hence the typical type of metrics are used the following methods:

- ROC Curve
- Recall and Precision
- F-Measure

ROC CURVE

The goal of ROC analysis is to recover the important elements while avoiding retrieving the unimportant ones. ROC (Receiver operating characteristic) curve illustrates and optimize the relationship between fallout and recall [Figure 5]. This is accomplished by maximizing the recall, also known as the (true positive rate), and minimizing the fallout, also known as (false positive rate). To identify an item as "to be suggested" or "not to be recommended," ROC curves analyzed to clearly depict the trade-off between recall and precision when the threshold is altered. The effectiveness of various algorithms is frequently compared using the ROC curve [15]. If an algorithm's ROC curve entirely outperforms the ROC curves of competing algorithms, it is more effective [12]. Additionally, the performance of various algorithms is frequently compared using the ROC curve. If an algorithm's ROC curve totally outweighs the ROC curves of other algorithms, it is considered to be more efficient [11]. The ROC measure is unaffected by the relevant elements' order when this is taken into account. An optimal ROC curve is produced when all relevant items appear before irrelevant items [16]. The region under the ROC curve to use it as a performance indicator [17]. The chance of the system being able to properly choose between two things, where one item is randomly selected from the set of acceptable items and the second item is selected from the set of unsatisfactory items, is represented by the area under the ROC curve.

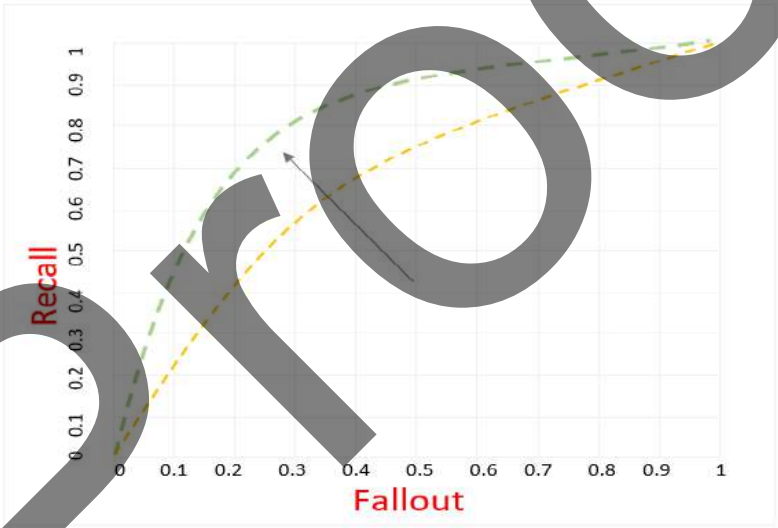

FIGURE 5. The Recall of ROC Curve which is Against to Fallout

RECALL AND PRECISION

A perfect predictive system generates a ROC curve that eventually reaches all of the corresponding objects encountered before heading for the rest of the items. To assess the effectiveness of recommendation models, we also use the accuracy measure (the proportion of correct recommendations to all possible recommendations) and the F1 measure (the harmonic mean of the precision and the recall). Predicted curve implemented by six measures equations [eq. 2 to 6] and precision and recall values show the results according to equation and user rating based values. The precision and recall serve as the foundation for the Precision - Recall curve [figure 6]. The sensitivity and complement of specificity form the foundation of the ROC curve. The recall is the same as the sensitivity, which is also known as the True Positive Rate, or TPR. Another name for the complement of specificity is false positive rate (FPR).

$$Precision = \frac{TruePositive}{TruePositive + FalsePositive} \quad (2)$$

$$Recall\ or\ TPR\ = \frac{TruePositive}{TturePositive+FalseNegative} \tag{3}$$

$$FPR = 1 - specificity = \frac{1-TrueNegative}{TrueNegative+FalsePositive} = \frac{FalsePositive}{TrueNegative+FalsePositive} \tag{4}$$

$$Accuracy = \frac{TrueNegative+TruePositive}{TrueNegative+FalsePositive+FalseNegative+TruePositive} \tag{5}$$

$$F1 = \frac{2*Precision*Recall}{precision+Recall} \tag{6}$$

A good recommendation system strives to simultaneously optimize both metrics i.e. it could offer suggestions to the customer for a range of products that will garner the greatest attention. The proportion of consumable things in the pool would stay constant, but the precision would stay low.

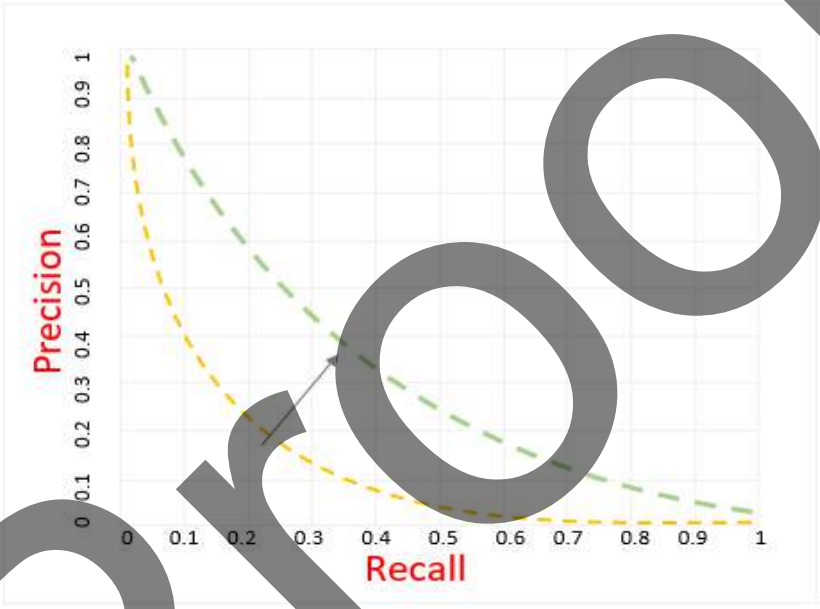

FIGURE 6. Basic Precision and Recall curve

Additionally, the performance of various algorithms is frequently compared using the ROC curve. If an algorithm's ROC curve totally outweighs the ROC curves of other algorithms, it is considered to be more efficient [11]. The same as with accuracy and recall measurements, ROC curves presume binary relevance. One of two categories are successful suggestion or an unsuccessful recommendation—is used to classify items. The ROC measure is unaffected by the relevant elements' order when this is taken into account. An optimal ROC curve is produced when all relevant items appear before irrelevant items [16]. We may examine the region under the ROC curve to use it as a performance indicator [17]. The chance of the system being able to properly choose between two things, where one item is randomly selected from the set of acceptable items and the second item is selected from the set of unsatisfactory items, is represented by the area under the ROC curve.

SPECIFIC F1-MEASURE

Another statistic generated from accuracy and recall is the F-measure, which behaves similarly to both of those measures. F-measures may be a more helpful statistic than accuracy and recall since they provide different information that, when combined, can complete each other. The metric that performs better than the other will be reflected in the F-measure. The F-measure is the number of tests that must be run in order to find the first failure from the standpoint of probability. The value of Fβ can be changed to give one measure more importance than another by

changing β. Though the most popular F-measure is the consistent mean of precision and recall (F1), where $\beta = \frac{1}{2}$, it is not widely used. Because the F-measure has a maximum value of 1, all forecasts and recommendations are correct. Following equations 7 and 8 display the results of the Fβ and F1 computations.

$$F\beta = \frac{Precision * Recall}{(1-\beta) * Precision + \beta * Recall} \quad (7)$$

$$F - measure = \frac{2 * Precision * Recall}{Precision + Recall} \quad (8)$$

CONCLUSION

This study provides in-depth analyses and types of recommendation systems, such as collaborative-filtering, demographic-based, content-based, utility-based, knowledge-based, hybrid-based systems, and context-based recommendation system. Additionally, many hybrid-based system combination methodologies are discussed and divided into weighted, switching, mixed, feature combination, cascade, feature augmentation, and meta-level categories. Cold-start, data sparsity, scalability, accuracy, threat of potential attack, habituation effect and diversity, as well as metrics used to assess its performance, are the key issues that have an impact on a recommendation system's performance. We have identified lots of recommendation methodology and according to different methodology we have created an effective basic architecture model which can effectively finding the accuracy degree and recommendation engine execution time span.

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The Prediction Analysis of Covid-19 Using Enhanced Deep Learning Network and Improvised Optimization Algorithms

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Abstract. To predict the effects, risks, and parameters of current pandemic the Artificial Intelligence methods have been used. The predictions should be supportive to prevent and control of this deadly disease. However there exist challenges in imposing AI technique because of their uncertainty and lesser volume of data. Used of neural network based Long Short-Term Memory (LSTM) for risk prediction of nearly 170 countries. For optimizing the prediction value Bayesian optimization technique has used. To take preventive steps this current study exhibiting a tool for predicting the long-duration pandemic. For prediction, the weather and trend data combined in this study. This model used soft computing and machine learning techniques for covid-19 outbreak prediction. Several issues such as uncertainty, essential data lacking, lack of robustness and required generalization deficient have been trying to overcome by this study. The two machine learning models have used in this work (fuzzy inference system and multi layered perceptron model with adaptive network). Despite the behavior variations seen in covid-19 from various countries and the COVID-19 difficult nature this study termed as an effective tool for prediction. Still need advancement in techniques to predict the long-term duration and required generalization ability. However, for long term prediction various other deep learning and machine learning techniques is considered. In addition to that the differences among the outbreak seen in other countries required global model comprised with generalization ability. Also, the most complex prediction stated is to evaluate the extreme number of covid-19 infected patients and at the same time evaluation deaths / infected patients is essential. Hence mortality rate in prediction analysis also significant in order to arranging the intensive care units. For the countrywide nations to plan new facilities among the outbreak the enhanced kind of modelling is essential.

INTRODUCTION

In this [1] study, the Artificial Intelligence methods have been used to predict the effects, risks and parameters of current pandemic. This deadly disease study will help to predict and control it from pandemic. Still there are More challenges to AI due to low volume of data using. Hence our new model of risk prediction is built for around 170 countries data by using neural network-based LSTM. Bayesian optimization technique has been used for prediction. For long-duration of pandemic, our study will act as a preventive tool for prediction analysis. The weather and trend data combined in this study for country wise accurate prediction. The soft computing and machine learning techniques are for covid-19 outbreak prediction [2]. The two adaptive network machine learning models have used in this work (fuzzy inference system and multi layered perceptron model). However, the behavior variations have been seen in covid-19 from country wise and the difficult nature of covid-19, so it will be considered as an effective tool for prediction. Still, it needs more advancement in techniques for the prediction of long-term duration and required generalization ability.

This [3] study focused on reduced LSTM technique with two alternatives named as LSTM 2 and LSTM 3 which have implemented on the Covid-19 dataset for prediction of time-series related to death toll and total confirmed cases. Hence three models have been compared with each other which used two activation functions and three various learning rates. Compared with recognized LSTM technique, the LSTM with bias showing lesser trainable parameters refer as LSTM 3 shows better performance through time series by speculating the covid-19 disease. Efficient computation resulted. Different kind of deep learning algorithms are developed in this field to predict the COVID-19 mortality, recovery, and newly infected rate. But they are lacked with some serious problem like long time to train, requires more memory to train, issued with over fit problems and dropout is harder to implement. So, to overcome these issues, in our research, we have concentrated on the hybridization of ResNet model with GoogleNet model for accurate COVID 19 predictions.

The outstanding part of this research paper is organized as follows: Section 2 contains detailed study of scientific background, Section 3 illustrates the objectives of the research, Section 4 describe the methodology, and the

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experimental results and discussion are visualized in section 5, and Section 6 is about the conclusion and discusses about the future directions.

SCIENTIFIC BACKGROUND

To diagnose the covid-19 patients faster, the AI algorithm which exhibits great accuracy has been used in this study. To battle with present pandemic, this study provides support [4]. This AI proposed model mixed the given clinical information and patient's CT images. it performed as screening tool and provided accuracy in detecting the covid-19 infectious disease and gives guidelines to radiologists and hence no physical tests required further to confirm the covid-19 positive cases. In this[5] research, the Gravitational search algorithm has focused for rapid diagnosis of covid-19 cases. Four main strategies followed in this study were collection of data, selection of hyper-parameters, learning and measuring the performance stage. Covid-19 dataset used in first strategy followed by optimization using GSA with CNN architecture hyper parameters named as DenseNet121. Using hyper-parameters values, the DenseNet121 has fully trained and in last stage it identified nearly 98 percent of covid-19 cases.

The effectiveness of the current study resulted while comparing with another method. This study [6] focused on prediction of upcoming days of covid-19 pandemic with respect to confirmed cases, a Forward Neural Network architecture and for performance improvement, the chaotic learning CL based Interior search algorithm ISACL method performed for the efficient prediction. The different forecasting model presented related with real-world forecasting. With time the researchers of this work analyzed and forecast the pandemic spread in terms of country. Efficacy and effectiveness resulted. In this [7] article deep learning and machine learning techniques have followed and performed on John Hopkins dashboard data of covid-19 spread analysis. The polynomial regression predicted trend followed and it shows that there may be high mortality rate due to the covid-19 transmission exponential growth globally.

To predict the covid-19, this paper [8] used LSTM technique and model of Holt-trend to predict committed and dying cases. The data aggregated from WHO in this study based on three countries such as Italy, Spain, and Saudi Arabia. The LSTM technique and Holt trend model shows their effectiveness towards predicting the cases of covid-19. The results of time series models are applied to assess the for saving many lives. Various other search terms like Google search trend are also considered for the prediction of covid-19 outbreak in future. This [9] study used techniques of Deep Learning for forecasting of covid-19 positive patients in India focusing 32 states. This study used various approaches like Bi-directional LSTM, Convolutional LSTM and Deep LSTM imposed on Indian dataset. Weekly and daily cases have been predicted by using these methods. Short term prediction resulted with greater accuracy. Based on the positive cases spread and growth rate various zones have been divided in India for quick diagnosis of covid-19 hotspots. Hence state-wise predictions and effective preventive measures have been made in India. This [10] research focusing on to predict the probable stopping time and trends of present covid-19 pandemic in Canada. For future prediction the LSTM model has been used in this study with respect to public datasets like authority of Canadian health datasets and john Hopkins's datasets. The transmission rates of Canada have compared with USA and Italy. Days wise prediction (2 following days) have been followed. According to this study, the infectious clusters in small numbers has been expected to be present until Dec 2020. But current pandemic duration may be minimized by international support and latest technological enhancements.

This Covid-19 based study [11] predicted the Covid-19 analysis related to which age group has highly affected due to this deadly disease. This study used [12]Random forest classifier and Random forest regressor and compared with various machine learning techniques to evaluate their performance in prediction analysis. Forecasting and assessment of covid-19 disease committed patients in forthcoming 10 days in China have been concentrated in this [13] study. The flexible neuro fuzzy inference system with slam swarm method improved the flower pollination algorithm have been implemented in this work and by using WHO official data of forecasting covid-19, this model has been evaluated. Better performance resulted. Various other datasets like weekly confirmed cases in China and USA have also been predicted and evaluated. To predict the covid-19 future mutation rates and time-series, this study [14] used RNN-LSTM model based on covid-19 patient's nucleotide mutation rate. Day basis mutation rates have also predicted by evaluating a greater number of infected people in time based. Prophet predictive analysis technique was pre-owned in this[15] study to divine positive covid-19 cases and also this study helpful for manufacturing the medicines in rapid rate by pharmaceutical companies. The prediction model in this study [16] has been based on Genetic Programming for identified the confirmed and mortality cases in Delhi, Maharashtra and Gujrat states in India. Time-series prediction of covid-19 with reliability have been resulted in this study.

This [17] paper overcome the huge estimation errors and time series population prediction issue while predicting the covid-19 confirmed cases using LSTM technique. This research used fitting goodness to assess the improvement in effect of fitting. And after comparison this study shows that it has greater fitting effect with smaller divergence in prediction resulted. From the Google trends search this study [18] obtained data to divine the covid-19 positive patients in Iran using the LSTM and model of Linear Regression. The data given by google trends have depends on the people interest so that in case for more accuracy in prediction other reliable informative data source should be used. Relevant keywords should be used to get the essential data. In addition to the above demerit, the prediction should be focused on huge amount of data like global prediction is essential other than focusing on one or two specified countries. [19] Gompertz, ANN and Logistics models used to commit the covid-19 cases in Mexico. Accuracy in prediction resulted due to the short-term prediction. Long term prediction is not focused on this study.

Covid-19 was an outbreak of unfamiliar diseases affecting the majorly respiratory system. The disease gradually exacerbates and inscribed the whole world. Majorly deteriorating population. The well versed and optimized methodology to predict Covid-19 is still questionable. However, state of the art techniques of Deep Learning clearly created a new path of superior prediction and forecasting. This study consists of two dimensions. First Dimension is that a new method of prediction has been established via COVID-19 patients registration slips. ResNet-101 has been applied to indigenous data set of COVID-19 patient's registration slips [21][23]. AI techniques could assist radiologists with rapidly and accurately detecting COVID-19 infection from these scans. This paper proposes an AI approach to classify COVID-19 and normal CT volumes. The proposed AI method uses the ResNet-50 deep learning model to predict COVID-19 on each CT image of a 3D CT scan [22][24].

In this research, COVID-19 prediction model is done with the help of hybrid algorithm which integrates two different deep learning algorithms like CNN. Different convolution and subsampling layers are tracked by more than one fully connected layer. Normally, fully connected layer is considered as a usual multilayer neural network, and it clasps output which is defined as class score. Input data is convolved by the convolutional layers which utilize several filters (learnable weights) to convolve the data and the data is down sampled by the poling layer. Average pooling and max pooling are two different kinds of functions in pooling layer. To obtain the final class score, CNN converts input data over different stacked layers also for different semantic segmentation models, CNN structures are used as building blocks. In our work, two different deep learning algorithms named as ResNet, and Inception (GoogLeNet) model are hybridized to perform the COVID-19 disease prediction and mortality as well as recovery rate prediction in two different datasets. Description about ResNet and Inception model are explained in section 4.

The below table 1 summarizes and compares the relevant approaches like deep learning, pre-processing, collaborative filtering, and other similar techniques used in existing research work to identify the user preferences for e-learning courses establishment.

TABLE 1. Existing research work comparison

S.No.	Author	Technique Followed	Description	Benefits/Limitations
1.	[1]	Long short-term memory and Bayesian optimization	Neural network-based LSTM is used in this study for risk prediction of nearly 170 countries. For optimizing the prediction value Bayesian optimization technique has used.	Predicting the long-duration pandemic and hence, possible preventive measures taken.
2.	[6]	MFNN Multilayer Feed Forward Neural Network architecture. Chaotic learning CL based Interior search algorithm ISACL method.	Prediction of upcoming days of covid-19 pandemic with respect to confirmed cases, recovery cases and mortality rates.	Efficacy and effectiveness resulted. Existing MFNN drawbacks should be avoided to give high quality result.

3.	[17]	LSTM	Predicting the covid-19 confirmed cases using LSTM technique.	Better fitting effect with smaller deviation in prediction resulted.
4.	[2]	Soft computing and machine learning model (ANFIS and MLP)	Covid-19 outbreak prediction.	Effective tool. Lack of generalization ability and long duration analysis required.
5.	[8]	LSTM and Holt trend technique.	Prediction of covid-19 committed and dying cases in Italy, Spain, and Saudi Arabia.	Accuracy in prediction. Various other search terms like Google search trend with efficient search is also considered in future.
6.	[9]	Bi-directional LSTM, Convolutional LSTM and Deep LSTM	Prediction of covid-19 positive patients in India	Essential precautionary measures and quick hotspot identification has been made based on state-wise predictions. Short term prediction but greater accuracy resulted. Applied to other countries also.
7.	[20]	Hybrid Artificial Intelligence	Predicting the covid-19 analysis related to developing trend and transmission law in China.	Sincerity, efficiency, and transparency.
8.	[10]	LSTM model	Predict the probable stopping time and trends of present covid-19 pandemic in Canada.	Short term duration, Accuracy.
9.	[13]	The flexible neuro fuzzy inference system with slam swarm algorithm improved the flower pollination algorithm	Forecasting and estimation of covid-19 committed cases in forthcoming 10 days in China	Better performance but short-term duration.
10.	[14]	RNN-LSTM model	Prediction of mutation rates based on infected people mutations.	Efficacy.

OBJECTIVE OF RESEARCH

Objectives of our research is given as bellow:

- To model the effective prediction analysis of covid-19 spread this is useful to impose relevant control measures and to take informed-decisions from nation to nation.
- To estimate the number of parameters such as positive cases/infected patients, mortality rates, recovery rates and other significant terms.
- To remove the unwanted words, different kind of pre-processing methods are utilized.

- To extract the features from the pre-processed data, term frequency inverse-term frequency (TF-IDF) and Bag of Words (BoW) methods are used.
- To implement the Mayfly Optimization (MO) algorithm for efficient and optimized feature selection of the given covid-19 related data.
- To classify the selected data for accurate prediction, the hybrid ResNet with GoogleNet model is developed.

METHODOLOGY

There are two different datasets are utilized in this study for accurate prediction and the first dataset is collected from an open-source data repository GitHub (https://github.com/Akibkhanday/Meta-data-of-Coronavirus). In which about 212 patient's data are stored which have shown symptoms of corona virus and other viruses. Data consists of about 24 attributes namely patient id, offset, sex, age, finding, survival, intubated, went_icu, needed_supplemental_O2, extubated, temperature, pO2_saturation, leukocyte count, neutrophil count, lymphocyte count, view, modality, date, location, folder, filename, DOI, URL. License. Clinical notes and other notes.

The second dataset used in the study has been obtained from the GitHub repository provided by the Center for Systems Science and Engineering, Johns Hopkins University [23]. The repository was primarily made available for the visual dashboard of 2019 Novel Coronavirus by the university and was supported by the ESRI Living Atlas Team. Dataset files are contained in the folder on the GitHub repository named (csse_covid_19_time_series). The folder contains daily time series summary tables, including the number of confirmed cases, deaths, and recoveries. All data are from the daily case report and the update frequency of data is one day.

PREDICTION ANALYSIS MODEL-1

For prediction analysis, Mayfly Optimization (MO) algorithm is used to select the relevant features from the extracted features and finally, hybrid ResNet with GoogleNet model is proposed to obtain the accurate prediction.

- This study evaluates the previous studies using health dataset and predict the future analysis of a greater number of infected persons and death rates in upcoming days.
- Unwanted words, and symbols are removed with the help of some pre-processing methods.
- Feature extraction is done with the help of TF-IDF and BoW methods.
- To generate the optimum parameter combinations the MO algorithm is used for feature selection.
- Finally, hybrid ResNet with GoogleNet model is proposed to predict the mortality rate, newly infected rate and so on.
- The proposed flow based on the above algorithms is shown below in figure 1.

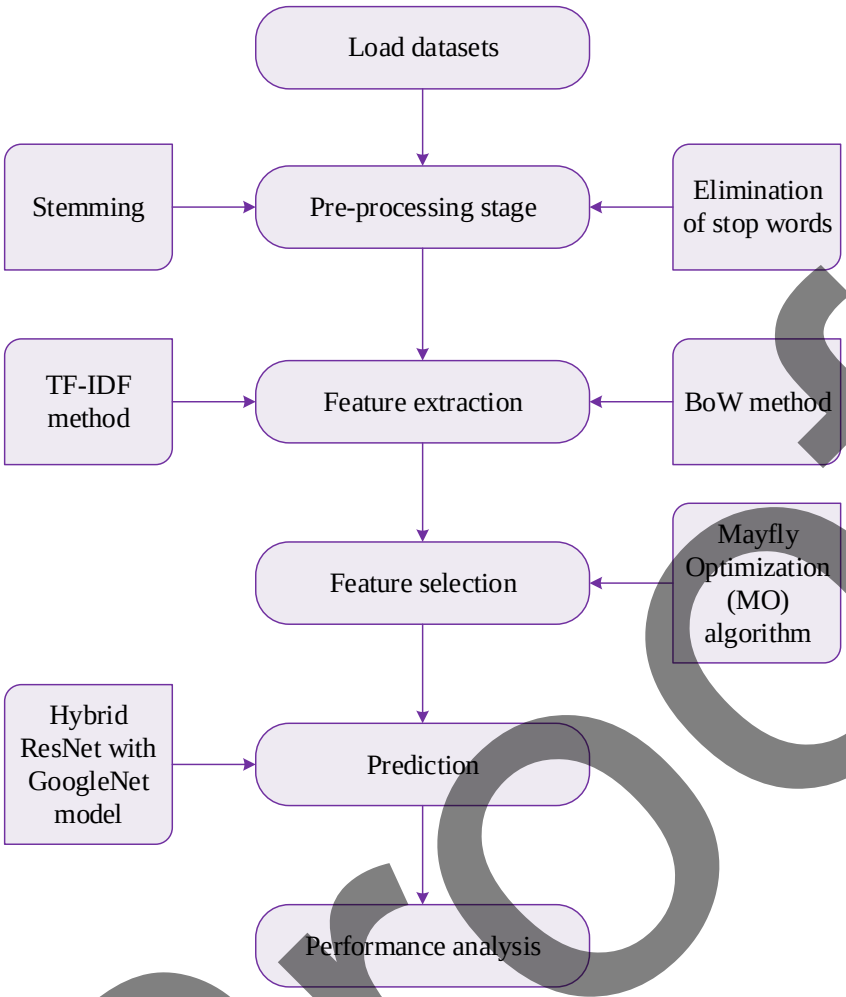

FIGURE 1. Advanced Workflow model of our proposed methodology

PRE-PROCESSING

Pre-processing is defined by transforming the raw data into an understandable format also it is a data mining technique. The text pre-processing eliminates the links, prepositions, abbreviations, and hash tags. After the acquisition of data, it should be properly pre-processed with different techniques like stemming and elimination of stop words.

FEATURE EXTRACTION

After pre-processing, different kind of features are extracted from the pre-processed clinical data and are converted into probabilistic values. Methods like TF-IDF and BoW are utilized to extract the features from the publicly available dataset.

FEATURE SELECTION

Feature selection as a combinatorial optimization problem is an important pre-processing step in data mining, which improves the performance of the learning algorithms with the help of removing the irrelevant and redundant features. So, in this research, Mayfly Optimization (MO) algorithm is used to select relevant features from the set of features.

CLASSIFICATION

In this research, benefits of both ResNet and GoogleNet model or inception model are combined to improve the detection accuracy of COVID-19 prediction as well as mortality and recovery rate prediction with this proposed hybrid model. Inception model and residual network demonstrates their capability to increase thousands of layers by offering better performance as well as enhanced efficiency.

PREDICTION ANALYSIS MODEL-2

The statistical and basic epidemiological methodology has gained a lot of attention from researchers to provide accurate predictions. To analyse COVID data, Machine learning and deep learning methods are particularly used throughout the world and are even used to commit future patients of COVID.

Another research method where we used Genetic Algorithm (GA), Competitive Random Search (CRS), and Long Short-Term Memory (LSTM). In this research, health dataset comprised of total number of infected covid-19 patients and dying rates with respect to age, sex, and ethnicity. Time series is generated for test data and train data. These time series are then used for model fitting. In both the predictions i.e., COVID infection cases prediction and COVID Death cases prediction, a total of 100 epochs are used to build the model. The history of all the epochs operations is stored in a single file and then it is plotted using matplotlib package. At last, the model's summary is analysed. All these operations are performed in Python language. The broad level methodology steps for cases predictions are shown in figure 2.

- Firstly, the optimum parameter combinations are generated using a Genetic Algorithm thus achieving feature selection.
- After feature selection, the classification process starts with the input layer.
- In the attention layer, the weights are updated by using Competitive Random Search (CRS) algorithm. The values obtained through competitive random search (CRS) techniques are then processed in the Long Short-Term Memory (LSTM) network.
- In the LSTM layer, using the Krill Herd Optimization technique (KHO) the respective weights are updated again.
- After the classification process, the output is generated and then analysed.
- The proposed flow based on the above algorithms is shown below in figure 2.

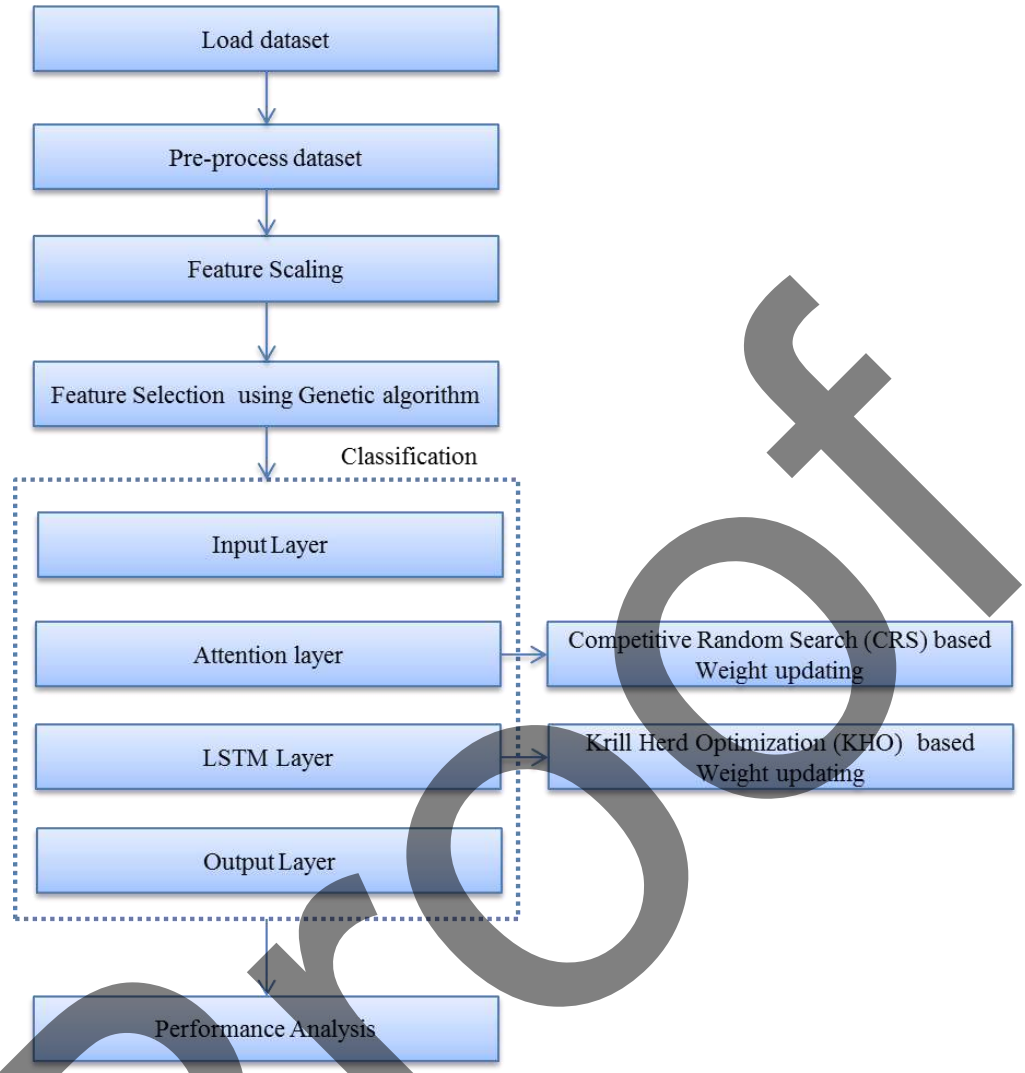

FIGURE 2. Prediction Analysis proposed flow

GENETIC ALGORITHM

To generate high-quality solutions, a Genetic Algorithm is used to optimize and search issues based on operators stimulated biological terms such as selection, mutation, and crossover. Here in this project, the Genetic Algorithm is used because it offers a distinct and practical approach to feature selection. In some cases, the Genetic Algorithm outperforms the feature selection methods that are available in the scikit-learn package. A few of the use cases of Genetic Algorithms in Machine Learning are Model Hyper-parameter Tuning, Feature Selection, Machine Learning Pipeline Optimization, etc. Genetic algorithms follow some terminology to solve complex optimization problems which are explained below:

INITIALIZATION

The prime population founds by generating genetic algorithm. Problems to the prime population consists of all the probable solutions.

FITNESS ASSIGNMENT

For every individual population, it assigns a fitness score. If the fitness score is high, then higher the chances of being selection for reproduction. For every individual it assigns a fitness score, which further discover the probability of being chosen for reproduction.

SELECTION

The main purpose of selection of individuals is to confirm the region with high chances of generating the best solution to the problem (better than the previous generation) for the reproduction of offspring. To enhance the reproduction of selected individuals, these are arranged in pairs of two. Now furthermore these individuals pass on their genes to the next generation.

REPRODUCTION

The formation of a child population from a parent population is involve in this stage. The algorithm employs disparity of operators that are relate to the child population to create it. Crossover and mutation these two parameters are involve in this stage. To generate equal numbers of offspring randomly, these operators are performed on parent pairs. Mutation computes new genetic knowledge to the new child population by flipping bits in the chromosome.

REPLACEMENT

Generational replacement is a substitution of the old population with the new child population. To improve the solution, the new population with higher fitness scores get included for indication.

TERMINATION

A stopping criterion is used to identify the best solution after replacement. The threshold fitness solution has been attained after terminating the algorithm. Then it will get considered as a best population solution.

ATTENTION LAYER

After the feature selection, the weights are updated in two steps. First, the Competitive Random Search (CRS) is pre-owned to update the weights. Specific inputs are selected in this layer and processed with greater attention given to those inputs. Generally, LSTM neural network uses attention layer. Here, the attention layer we used is imported from Keras, TensorFlow. Attention layer can also be called as a mechanism that can help a neural network to remember long sequences of the information or data.

COMPETITIVE RANDOM SEARCH (CRS)

Rather than simple random search, here we used competitive random search algorithm for the weight updation process. For feasible estimation, the competitive random search is used, and the obtained value is made as input to the attention layer, and the weights are updated.

LONG SHORT-TERM MEMORY (LSTM) LAYER

The second step of weight updation occurs in this layer. Long Short-Term Memory (LSTM) is considered as a composite area of deep learning. LSTM is used in deep learning models based on an artificial recurrent neural network RNN. It is skilful independence of learning order in a problem of sequence prediction. For complex problem-solving LSTM is used. In our project in the LTSM layer, Krill Herd Optimization (KHO) is used to update the weight.

KRILL HERD OPTIMIZATION KHO

The most recent heuristic optimization algorithm is considered as Krill Herd Optimization KHO. Based on the krill life cycle in oceans, this algorithm is developed. The obtained values through KHO are given as input to the LSTM layer and the weights are updated.

Hofmann et al. discovered three essential factors of individual krill position as:

i. Krill individuals' movement induced
ii. foraging activity; and
iii. random diffusion,

which can be formulated during the time and for n dimensional space, using the following Lagrangian model:

$$\frac{dxi}{dt} = ni + fi + di \quad \text{(I)}$$

where Ni, Fi and Di are Motion induced by other krill individuals, Foraging motion, and Physical diffusion respectively [21].

RESULTS AND DISCUSSION

The prediction analysis performed by using the enhanced deep learning and the various machine learning algorithms. An enhanced krill herd bioinspired algorithm is used for the prediction of the covid-19 dataset. According to WHO, the COVID-19 pandemic declaration was announced in March'20. This deadly virus has spread globally, and millions of people have been affected the death rate is also high in more countries.

Hybrid ResNet with GoogleNet model is proposed to obtain the accurate prediction. The classification model is built for competitive random search algorithm, which is design by considering training, testing, LSTM classifier with single fold for both deaths and cases.

The biologically inspired KHO algorithm is based on a counterfeit of individual krill herding behaviour. The aim function for krill migration is influence by the smallest distances between each individual krill and the greatest density of the herd. Three key variables influence the krill's' location over time: I movement triggered by the presence of other individuals, (ii) foraging activity, and (iii) random diffusion. Two adaptive genetic operators are added to the algorithm for more detailed simulation of krill behaviour.

Table 2 and Table 3 shows that the loaded models for deaths and cases, respectively.

TABLE 2. Loaded model from disk for deaths

Type of Layer	Output Shape	Param #
lstm_1 (LSTM)	(None, 100)	40800
dense_2 (Dense)	(None, 1)	101

Table 3. Loaded model from disk for cases

Type of Layer	Output Shape	Param #
lstm_3 (LSTM)	(None, 100)	40800
dense_6 (Dense)	(None, 1)	101

The following figure 3 shows the model loss for death which The Test Set Evaluation Score 0.007318274118006229 and 0.0012482635211199522 for cases as shown in figure 4.

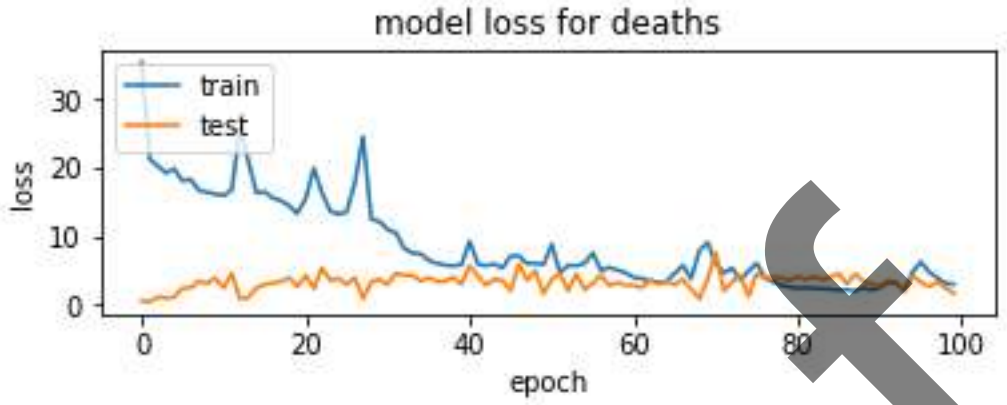

FIGURE 3. Model Loss for Death

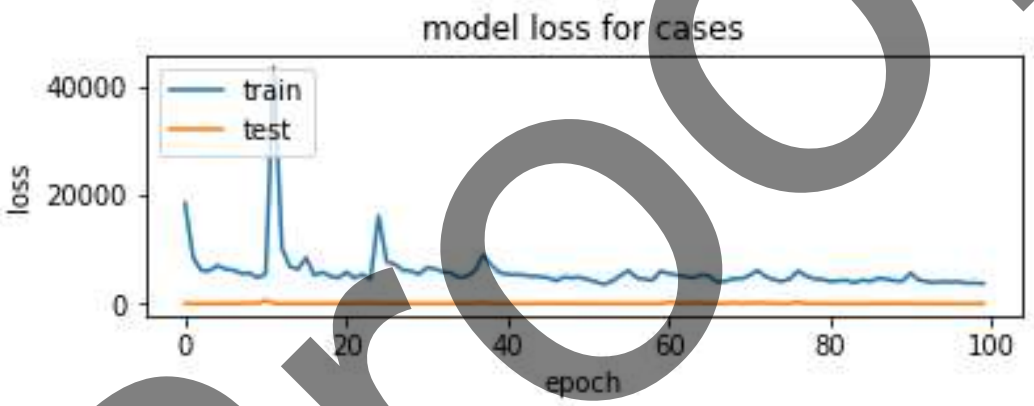

FIGURE 4. Model Loss for Cases

CONCLUSION

The expected result from this study is mainly focused on the accurate prediction of covid-19 analysis related to number of contaminate patients and dying rates. The no. of deaths is predicted from the total cases. Two models are generated namely model loss for death and model loss for cases. LSTM technique is used to predict the deaths ration for 170 countries. The proposed models provide the 98% accuracy. In future, hybrid model can improve the prediction rate for no. of parameters which are not limited to the deaths only for new variant of the COVID-19 diseases.

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Object Detection and Collision Time Estimation - Review

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Abstract. The field including self-driving & autonomous vehicles currently undergoing rapid development. Administrations now making every effort in improving motorist knowledge of the responsibilities being employed in driving a car entail. Researchers continuously working hard in making vehicles as safe as possible so that the tragic incidents possibilities on our roads may be reduced. A crucial element in almost 30% of these collisions now being speeding. Speeding has been a highly researched topic among significant car firms many decades, & it continues to be so today. The European Union (EU) recently proposed new policies aimed at reducing car accidents that will be implemented in 2022. The most important seems to be the requirement that all new automobiles made that year include an intelligent speed assistance technology smartly alerting the driver when the vehicle exceeds the posted speed limit. Regrettably, the oldest cars will continue to be without the system. This work reviews such research work which have been done in the same field that is intelligent speed assistance device & also this study's goal resides in contributing towards this research including a system-detection enabled & recognizing objects & making judgments, smartly assisting the user in making the driving experience easier & safer into a realistic driving simulator. The CAR Learning to Act (CARLA) simulator being employed in this investigation & it produced accurate findings regarding vehicle detection & distance estimation in real-time processing.

INTRODUCTION

The distance to impact has regularly been utilized as a danger appraisal metric for traffic wellbeing investigations. In road re-enactment models, Time to Collision (TTC) is frequently a basic component of a driver's direction and the board dynamic interaction. TTC evaluates the association power among vehicles. Notwithstanding, figuring the TTC isn't minor. Projections of future communications among vehicles include making anticipated directions for the subject vehicle just as any remaining vehicles with which cooperation may happen to check whether impacts may happen. The goal of this paper is to review such works who have been done in the field of safety of the road users and along with it will also consider & assess calculations efficiently utilizable in registering the latest TTC in miniature re-enactment-based models. Several authors have been done so many works in this field and in this section, this work shall put some light on the same

Liang Zhao et al. [1] utilized this framework as a Bus Driver Assistance project's feature [2] specially targeting towards fostering the cutting-edge side impact cautioning framework. To accomplish this objective, frontal area objects are first distinguished through forefront/foundation division "looking at the presentation of the CMU framework and MIT frameworks" in light of sound system vision. Each item is then named walker or non-person on foot via a prepared 'Neural Network'. Sound system driven item discovery plus 'Neural Network-based' person on foot recognition now being the two important components in keeping the framework strong & ongoing. In distinguishing the walkers from a moving vehicle, the framework effectively combines 2 1/2 D data with power data. The 'Neural Network' being prepared on numerous passer-by and non-person on foot information extricated from complex scenes; along these lines, it is pertinent to different genuine circumstances. The examinations on numerous metropolitan roads scenes exhibit that the proposed calculation:

- Efficient in recognizing walkers in different postures, shapes, sizes, apparel, & impediment status
- Continuously employable.
- Being hearty towards enlightenment & foundation changes.

Showing Ren et al. [3] has introduced Region Proposal Networks (IPNS) for effective and exact locale proposition age. "By sharing convolutional highlights with the down-stream recognition network, the area. The proposition step here being almost sans cost. Their technique empowers a brought together, deep learning- based article recognition framework in running at 5-17 fps. The learned RPN likewise further develops area proposition quality." Along these lines the general item discovery precision:

Kristofer D. Kusano et.al. [4]. Presented a technique for assessing the immediate TTC exactly when a striking vehicle's driver applied the brakes in keeping away from a lead vehicle halted, backside impact. Initially, a strategy for assessing

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TTC at the hour of brake inception was fostered that inspected the pre- crash brake application and vehicle speed. “On the off chance that the lead vehicle was halted, the TTC can be assessed utilizing the normal deceleration during the slowing down period, the time before sway at which slowing down began & the vehicle's speed when slowing down began. Of the 59 cases with complete EDR records, 12 drivers (20%) appeared to not have any significant bearing the brakes by any stretch of the imagination. The strategy for deciding TTC at slowing down beginning was shown utilizing 47 lead vehicles halted, backside crashes. The normal slowing down deceleration of those cases that had adequate vehicle speed information was observed to be 0.52 g's. The normal TTC of drivers in the chose cases differed from 1.1 to 1.4 seconds.”. Subsequent effects regarding primer examination concur well through a few recently distributed investigations, & ought to be seen as a brief look at the capability of a bigger example of the overall driving populace. This investigation exhibits the plausibility of utilizing EDR information to anticipate TTC in genuine circumstances.

Abbad Ur Rehman et. al. [5] planned a regulator for Vehicle impact counteraction framework is a fundamental and a recipient venture towards programmed control frameworks. To plan such a framework three significant contributions for the vehicles are thought of. Vehicle speed, distance from driving vehicle and static grating coefficient between the tires of vehicle and street. The SFC esteems are distinctive for wet, typical and dry surfaces. They have utilized fluffy rationale to execute the Mamdani model. Diverse different methods like Simulink and neural networks are being utilized to plan a regulator for information sources and yields. In this framework, FLC is utilized to acquire controlled yields relying upon the conditions upon the street. The outcomes are shown in surface watcher charts regarding the characterized rules having a place with their particular allotted participation capacities. Their planned framework has likewise been confirmed in the Mamdani recipe by placing explicit qualities in yields and information sources. There is a minor contrast between MATLAB recreated qualities and equation arranged numerical estimations. The created blunder is about 1.30%.

Doecke S.D. et. al. [6] contemplated AEB can possibly decrease the effect speed, & “subsequently the seriousness, in common crashes, right turn crashes, head on crashes, backside crashes and hit fixed article crashes.” Apparently, mentioned blunders may practically possess zero impact on right point crashes, yet auxiliary impacts that work on driver's capacities to stay away from impacts might be significant for this situation. Potential advantages give off an impression of being most noteworthy in common crashes, backside crashes and head on crashes. The varieties in framework detail show the upsides of a more extended opportunity to-crash and higher self-sufficient deceleration. A framework that can possibly produce bogus cautions than different frameworks was thought of & “exhibited Potential for decreasing the effect speed in common, head on, backside & hit fixed item crashes.” Precise item acknowledgment under testing circumstances is central for certifiable “deep learning applications for Avs” [7]. Now it’s being extensively recognized pointing towards the article acknowledgment computations’ improvement; requiring the implantation regarding plant stages: (1) common thing ID stage, and (2) deep learning-maintained item disclosure stage.

‘Viola Jones Detectors’ [8], ‘Histogram of Oriented Gradients (HOG) include descriptor’, & ‘Deformable Part-based Model (DPM)’ [9] is generally the regular conventional item discovery calculations. Albeit the present most created approaches have far outperformed the exactness of ordinary procedures, various transcendent estimations are still deeply affected by their huge pieces of information, similar to mixture models, bouncing box relapse, etc. Regarding the deep learning-based article discovery draws near, the cutting-edge techniques incorporate the “Regions with CNN highlights (RCNN) series”, Single Shot Multi Box Detector (SSD) series & You Only Look Once (YOLO) series.

Girshick et al. initial brought deep learning into the article identification field by proposing RCNN in 2014” [10]. Later on, Fast ‘RCNN’ & ‘Faster RCNN’ were made in accelerating revelation speed. In 2015, the main stage object finder, i.e., ‘YOLO’ being proposed. Starting now plus into the foreseeable future, the YOLO series estimations have been incessantly proposed & improved, for example, ‘YOLOv3’ [11] now being potentially the most notable strategies, & ‘YOLOv4’ is the ‘YOLO’ series’ latest version. To handle the trade-off issue among speed and precision. Liu et al. proposed ‘SSD’ [12] in 2015, which presents the relapse advancements for object discovery. Then, at that point, Retina Net was proposed in 2017 to additionally further develop discovery exactness by acquainting another shortfall work with reshape the standard cross-entropy deficit. Performing accurate way distinguishing proof consistently is a basic limit of state-of-the-art driver-help structures (ADAS) [13], since it engages AVs to drive themselves inside the road ways viably to avoid accidents, and it maintains the subsequent heading masterminding decision and way departure. “Customary path identification draws near means recognizing way sections subject to assorted high-quality prompts; for example, shading based provisions, the design tensor, the bar channel, & edge highlights.” This data is normally joined with a ‘Hough-transform’ [14] & “particle or Kalman filters” in detecting-lane markings. Eventually, at that point, post- preparing techniques being successfully utilized in sifting through misdetections & group path focuses towards yielding the last path identification results. Nonetheless, by and large, they are inclined to viability issues because of street scene varieties, likewise- changing between city scene & parkway

scene, being difficult in accomplishing sensible precision under testing situations having a lack in information's visual view. "As of late, significant learning-based division approaches have overpowered the acknowledgment field with more definite execution". For instance, VGG Net [15] proposes a different undertakings network for way stepping distinguishing proof. To all the more likely use more visual data of path markings, CNN applies a clever convolution activity that totals different measurement data through preparing cut provisions & afterward these being added all together. Light-weight DNNs have been presented regarding the steady applications in speeding up the revelation speed; alternative methods like sequential prediction & clustering have also been introduced.

RESEARCH GAP

This paper reviewed such articles in which the authors focused on the problem faced by the road users. All the methods which were discussed by previous authors are very helpful for the future researchers. Somehow, the author found that there is some more advancement can also be done in the same field. So, this work is going to introduce the best and economic method for solving the problems which are related with the object detection, computation of Time to Collision (TTC), virtual sensors and many more which can be possible with the simulator known as CAR Learning to ACT (CARLA).

METHODOLOGY

"CARLA (Car Learning to Act), an open-source test system for independent driving examination. CARLA has been created starting from the earliest stage to help improvement, preparing, and approval of independent metropolitan driving frameworks. Notwithstanding open-source code and conventions, CARLA gives open computerized resources (metropolitan designs, structures, vehicles) that were made for this reason and can be utilized unreservedly. The recreation stage upholds adaptable particular of sensor suites and ecological conditions. We use CARLA to concentrate on the presentation of three ways to deal with independent driving: an exemplary secluded pipeline, a start to finish model prepared by means of impersonation learning, & a start to finish model prepared through support learning." [16] The methodologies are assessed in controlled situations of expanding trouble, and their exhibition is inspected by means of measurements given via CARLA, showing the stage's utility for independent driving research. "In this paper, we present CARLA (Car Learning to Act) – an open test system for metropolitan driving. CARLA has been created from the beginning to help preparing, prototyping, and approval of independent driving models, including both insight and control. CARLA is an open stage. Extraordinarily, the substance of metropolitan conditions gave CARLA is additionally free. The substance was created without any preparation by a committed group of computerized craftsmen utilized for this reason. It incorporates metropolitan designs, a huge number of vehicle models, structures, pedestrians, road signs, and so forth. The re-enactment stage upholds adaptable arrangement of sensor suites and gives flags that can be utilized in preparing driving methodologies, for example, GPS organizes, speed, speed increase, and definite information on crashes and different infractions." [17] A wide scope of natural conditions can be determined, including climate and season of the day. That connects with the world. To help this usefulness, CARLA is planned as a worker customer framework, where the worker runs the re-enactment and renders the scene. The customer API is carried out in Python and is liable for the association between the independent specialist and the worker through attachments. The customer sends orders and meta-orders to the worker and gets sensor readings consequently. Orders control the vehicle and incorporate guiding, speeding up, and slowing down. Metacommands control the conduct of the worker and are utilized for resetting the recreation, changing the properties of the climate, and adjusting the sensor suite. Ecological properties incorporate climate conditions, brightening, and thickness of vehicles and pedestrians [18].

The code is set on a store split into the two various types of cups. However, it is feasible to add code to each cup catalog exclusively, the two of them access similar code for the essential programming arrangements which is valuable for errands that must be accomplished in the two cups. The correspondence inside the code goes through a Robot-Operating-System (ROS) which utilizes supporters and distributors on hubs to impart between the contents [19].

For instance, the TTC that will get determined by my content will be distributed through a hub to a point. Different contents can buy into this theme to get the TTC. This framework makes it simple to make a measured code structure. Since the shipment of the 1:10 model vehicle parts were deferred and the admittance to the test track was incomprehensible around then, the utilization of the CARLA (CAR Learning to Act) test system proved to be useful to acquire the information required for the estimations. This implies that the final products were never tried on the genuine model vehicle. "The way into the technique isa basic, direct approach to decide when the "subject" vehicle will "contact" a "target" vehicle. As per the user may expect, the mathematical shapes accepted for the two vehicles fundamentally affect the intricacy of and time needed for the estimations. Despite the fact that we accepted that the

vehicles are essentially square shapes when projected to the plane, we need to manage the cushion regions in figuring the TTC. Henceforth the shape utilized in the examination ought not to be the actual square shape. It ought to be bigger or even an alternate shape [20].

Another motivation to consider various shapes is that the mathematical highlights of the shape will impact the intricacy of the calculation. In the accompanying content, four calculations are talked about dependent on various shapes." [21,22] Before estimation of TTC we first need to recognize the concerned item in the field of perspective on our inner self vehicle to accomplish this we need to foster an insight model for it. With a camera sensor appended to our inner self vehicle we will identify objects like walker traveller vehicles, trucks alongside the edge of bounding boxes around them [23]. For the computation of Time to Collision of the ego vehicle it is important to locate the different users like walker traveller car, truck etc., for this purpose there are several virtual sensors available in the CARLA simulator discussed below:

CAMERA

Camera picture gives direct 2D data, making it valuable in certain assignments like item order and path following. Likewise, the scope of the camera can change from a few centimetres to approach 46 meters. The somewhat minimal expense and commercialization creation likewise add to the total arrangement in the genuine self-sufficient driving vehicle [24]. Nonetheless, in lights view, the camera's picture may be influenced via. low lighting otherwise awful climate conditions [25]. The camera diminishes' convenience being essential especially, under hefty haze, pouring, & snowing. Furthermore, the information from the camera is likewise a major issue. All things considered, each second, one camera having creation capability: 20-40MB information [26].

RADAR (RADIO DETECTION AND RANGING)

"The radar's complete name is Radio Detection and Ranging, which intends to identify and get the distance utilizing radio [27]. The radar strategy estimates the Time of Flight (TOF) and ascertains the distance and speed. For the most part, the functioning recurrence of the vehicle radar framework is 24GHz or 29GHz. Contrasted and 24GHz, 29GHz shows higher exactness in distance and speed location. Furthermore, 29GHz has a more modest radio wire size, and it has less impedance than 24GHz. For 24GHz radar, the greatest location range is 22 meters, while the most extreme reach increases to 200 meters for 29GHz radar." [28-30].

LIDAR (LIGHT DETECTION AND RANGING)

"Like Radar, LiDAR's distance data is likewise determined dependent on the Time of Flight (ToF) [31]. The thing that matters is that LiDAR utilizes the laser for checking, while radar utilizes electromagnetic waves. LiDAR comprises a laser generator and a high exactness laser recipient [32]. LiDAR produces a three- dimensional picture of articles, so it is generally used to identify static items and moving articles. LiDAR shows great execution with a reach from a few centimetres to 200 meters, and the precision of distance goes to centimetre-level. LiDAR is broadly utilized in object identification, distance assessment, edge discovery, SLAM and High-Definition (HD) Map age." [33] Contrasted to the camera, LiDAR shows bigger detecting reach and its presentation is less influenced by terrible climate and low lighting. LiDAR can produce very nearly 10-22MB of information each second, a gigantic measure of information for the figuring stage to measure continuously [34].

ULTRASONIC SENSOR

"Ultrasonic sensor depends on super solidity to recognize the distance [35-38]. Ultrasound is a specific sound that has a recurrence higher than 20 kHz. The distance is additionally recognized by estimating TOF. The ultrasonic sensor's information size is near the radar, which is 10-46KB each second. Moreover, the ultrasonic sensor shows great execution in terrible climates and low lighting climate. The ultrasonic sensor is a lot less expensive than the camera and radar [39]. The cost of the ultrasonic sensor is in every case under $46.The weakness of ultrasonic sensors is the greatest scope of just 20 meters, restricting its application to short-go locations like stopping help."[40].

GPS/GNSS/IMU

With the exception of detecting and impression of the general climate, limitation is likewise a critical undertaking running onto the self-governing driving framework's top [41]. "In the limitation arrangement of the self-governing

vehicle, GPS, GNSS, and IMU are broadly conveyed. GNSS is the name for all the satellite route frameworks, including GPS created by the US, Galileo from Europe, and BeiDou Navigation Satellite System (BDS)" [42] from China. "The exactness of GPS can change from a few centimetres to a few meters when distinctive perception estimates and diverse preparation calculations are applied" [43]. "The qualities of GPS are low expenses and the non-amassing of mistakes over the long run [44]. The disadvantage of GPS is that the GPS conveyed on current vehicles just includes precision inside one meter: and GPS requires an unhampered view in the sky, so it doesn't work in conditions like passages, for instance. Additionally, the GPS detecting information refreshes each 46ms, which isn't sufficient for the vehicle's continuous limitation [45,46,47]. IMU represents an inertial estimation unit, which comprises spinners and accelerometers. Gyrators are utilized to quantify the tomahawks' precise speed to compute the transporter's position. In examination, the accelerometer estimates the article's three tomahawks' direct speed increase and can be utilized to compute the transporter's speed and position [48]. The strength of IMU is that it doesn't need an unhindered view from the sky. The downside is that the exactness is low, the mistake is gathered with time. IMU may be a correlative sensor to the GPS since it has a refresh worth each 5ms, & it works suitably in conditions like passages. Usually, a Kalman channel is applied to consolidate the detecting information from GPS and IMU in getting quick & exact limitation results" [49].

DEPTH CAMERA

A depth camera then again, has pixels which have an alternate mathematical worth related to them, which number being the separation from the camera, or "depth."[50-53] Some depth cameras have both a RGB and a depth framework, which can give pixels with every one of the four qualities, or RGBD. All depth cameras give you the upside of extra comprehension about a scene, and that's only the tip of the iceberg, it enables any gadget or framework to comprehend a scene in manners that don't need human mediation. While it's feasible for a PC to comprehend a 2d picture, it requires huge venture and time in preparing an AI network (for more data on this subject you can look at this post) [54]. A depth camera innately gives some data without the requirement for preparing, for instance, it's simpler to recognize frontal area and foundation objects from a scene [55-57]. This becomes valuable in things like foundation division a depth camera can eliminate foundation objects from a picture, permitting a green-screen free catch. Depth cameras are likewise extremely helpful in the field of advanced mechanics and self-sufficient gadgets like robots – on the off chance that you have a robot or robot exploring its direction around a space, you would presumably need to naturally distinguish if something shows up straightforwardly before the robot, to keep away from crash. In this video that is actually the utilization that the depth camera serves, as well as making a 3d guide or sweep of the space [58].

DATA ANALYSIS

The data is gathered with the CARLA simulator [59]. The CARLA test system comprises a versatile customer worker engineering. The worker is answerable for everything related with the actual recreation: sensor delivering, calculation of physical science, reports on the world-state and its entertainers, etc. As it focuses on practical outcomes, the best fit would be running the worker with a committed GPU, particularly when managing AI. The user side comprises an amount of user modules controlling the rationale of entertainers on scene and setting world conditions [60-64]. This is accomplished by utilizing the CARLA API (in Python or C++), a layer that intervenes among workers and customers that is continually developing to give new functionalities [65].

Assortment of information in Carla world where we ran personality vehicle in autopilot mode around Carla world Then marked or commented on the information the information physically with programming naming, The information is Split in two sections preparing data (3426 pictures) and testing data (264 images) [66]. Along with their comments relating to each picture in particular envelopes. The TensorFlow2.2 Object Detection is an expansion of the TensorFlow Object Detection API [67,68,69]. The TensorFlow2.2 Object Detection permits you to prepare an assortment cutting edge object identification models under a brought together system, including Google Brain's best in class model Efficient Det (executed here). All the more for the most part, object identification models permit you to prepare your system in recognizing objects in a scene via. bounding boxes & class marks. There exist numerous ways regarding the deep learning procedures' utilization in demonstrating proposed issue & the TensorFlow2 [70].

Table 1. Comparative analysis with previous author's work with our proposed method.

S. No	Author	Service	Features

1.	Liang Zhao et al. [1]	Bus driver assistance device	CMU framework and MIT framework, Neural network based, Foot recognition, Continuous deployment.
2.	Showing Ren et al. [3]	Introduction regional proposal networks. (IPNS)	Convolutional highlights, deep learning-based framework, 5-17 running fps.
3.	Kristofer D. kusano et al. [4]	Immediate TTC (time to collision)	During applied breaks, utilizing EDR information to anticipate TTC.
4.	Abdad Ur. Rehman et al. [5]	Vehicle impact concentration	Mamdani model applied, Simulink library used, neural network framework, FIC framework.
5.	Our proposed model	Intelligent speed assistant device.	Carla simulator, radio detection and ranging, light detection and ranging (LIDAR), anticipated TTC.

According to the Table 1, object detection API permitting in conveying a wide range regarding the models & methodologies in accomplishing the proposed objective [71]. We train the littlest Efficient Det model (EfficientDet-D0) 512x512. Number of steps for preparing is 3200k time, takes 10 hrs. of dedicated training and on GPU Nvidia 1650 gtx GeForce 4 GB RAM. Assets given by Google Colab Pro. To compute TTC we first need to recognize the concerned item in the field of perspective on our conscious vehicle [72]. To accomplish this, we need to foster an insight model for it. With a camera sensor connected to our conscious vehicle we will recognize items like walker traveller car, truck alongside the age of bounding boxes around them. The model utilized for object location is a discernment model. Item identification is a system to distinguish class occasions to which an article has a place. To acquire a total 3D perspective on the climate, self-driving vehicles need to order various items present in a picture, and exact areas of these article [73].

CONCLUSION

The present work proposes the application of artificial intelligence in the vehicles of future as well as can be utilized for the present road vehicles, using the various available sensors such as Depth Camera, RGB Camera, GPS, RADAR, etc. and actuators integrated with the output of sensors through ECU, for developing the various techniques of enhancing vehicle safety. In the proceeding of this research, an algorithm of artificial intelligence will be developed/finalized, which can be further used for prediction of steering-angle/autonomous braking relative to real time road conditions for determining the action/actuation required by the driver or the algorithm (autonomously) in order to safeguard the occupants of the vehicle as well as outsiders and maintain the dynamic stability of the vehicle. “The recent proliferation of computing and communication technologies like machine learning, hardware acceleration, DSRC, C-V2X, and 5G has dramatically promoted autonomous driving vehicles. Complex processing frameworks are intended to use the sensors and calculation gadgets to comprehend the traffic conditions accurately progressively. In this, authors have developed an object detection model to detect objects in field of view (FOV) of the camera sensor of the ego vehicles through an algorithm which will be used for locating the object; it is one of the important parts objects ahead of the vehicle of our perception model.” [38] This paper introduces a depth camera sensor and RGB camera the sensor fusion to fuse the RGB camera sensor object detection data with depth data of depth camera.

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An Assistive Concrete Blended Modeling Technique for Mesothelioma Disease Prediction Using Machine Learning

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Abstract. Mesothelioma is a variation of cancer that is generally found in the thin layer of tissue. This tissue covers the majority of our internal organs. This cancer is said to be very fatal, though treatments for mesothelioma are available, but a concrete cure for this disease isn't possible. So, using the data of patients with mesothelioma the goal of this study is to analyze what features are more responsible for the cause of this disease and what strategies we can use to predict and prevent this disease using machine learning and data science technologies. After analyzing the data of the patients and applying and comparing themachinelearningalgorithmsandusingseveralensembletechniquesitwasobservedthatthe Extra Trees Classifier and Blended model of Random Forest, Extra Trees, Light Gradient Boosting Machine and Gradient Boosting model comes on the top as the best classifiers with0.9228 and 0.9301 AUC respectively. 10-fold CV (cross-validation) is used to validate the result. The data was prepared by Dicel University Faculty of Medicine in Turkey.

INTRODUCTION

When people who generally live in rural areas which are exposed to asbestos a type of mineral generally found in the soil mixture called as white soil [7][19]. When asbestos from soil in inhaled by a person, it sits inside of the lung and damages the inner lining of the lungs which leads to a very fatal tumors of the pleura thus leading to Malignant mesotheliomas (MM). It is a rare disease. About 10-20 lakh per year in general population [1][20]. Though it is rare it is a fatal disease with no cure. Common symptoms of this disease include Chest pain, shortness of breath, unusual lumps of tissue under the skin on your chest, painful coughing. MM was found in most of the people who are exposed to asbestos fiber at work [5][18]. These people include Plumbers, Asbestosminers, Electricians, Pipefitters, Insulators, etc. [9][17].

In this we first going to talk about the data that we have. We are going to explore it, try to find out what characteristics it has. Then we are going to preprocess the data and make the data cleaner. Generate models using the cleaned data and evaluate them using some parameters and visualization. Then we are going to explore some ensemble techniques to improve results. This has great value in predicting the mesothelioma diagnosis, better treatment, and toxicity minimization in patients. The rest of this paper is arranged as follows. Section 2 contains the detailed description of the literature survey, Section 3 illustrates the Materials and Methods used, Section 4 shows the experimental results and Section 5 is the conclusion.

LITERATURE REVIEW

In Orhan Er et.al. [8] they claimed that Malignant mesothelioma (MM) is tumors that is very aggressive. Mesotel cells and pleura cells are the cells which are affected by this disease. The PNN, multilayer and learning vector quantization were compared. It was observed the PNN is the best classification with 96.30% accuracy obtained via 3-fold cross-validation. Chao Tan et. al. [10] investigated amalgamation of Adaboost to see the effect of element analysis and to predict lung cancer. From 122 urine samples, 9 trace elements were found in the cancer dataset which was used in this study. The adaboost forecast and Fisher Biased Analytic (FDA) results were compared. Both cases shown 100% of Adaboost's sensitivity. Case A and Case B shown 93.8% of accuracy and 96.7% accuracy respectively. Early lung

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cancer can be diagnosed if an amalgamation of Adaboost as well as urine analysis method is used in clinical practice. Adaboost was found performing well than the FDA.

Maciej Zięba et al. [11] in 2014 found that for solving irregular results, boosted SVM was very useful. The advantages of ensemble classifier and support vectors were combined to provide a solution for uneven data. The effectiveness of the answer to the problem put forth was evaluated by contrasting the performance of the data with various other algorithms. Finally, expectation of life in patients with lung cancer was estimated with improved SVM. In [12] N. Picco et. al. used Artificial Neural Networks and Decision-making Trees with SVM to examine prostate cancer survival. The precision predictor gave an accuracy of 92,85%. More efficient neural networks were determined by comparing data on patients suffering from colon cancer with predicted survival patients.

Vishal Bharti et.al. [13] claimed that facts in medical research can be found out using machine learning**.** Rapid disease prediction with high accuracy can be done using machine learning algorithms. Main focus should be given to generating a hybrid model of different algorithms for predicting different types of diseases prediction. The paper also explored how to improve the performance of individual classifiers with the use of hybrid approaches. In [6] Yazicioglu S et.al. collected the data of 7000 people from the population. The data showed that 461 (6.5%) of the total population was suffering with pleural thickening and calcification, while 103 (1.47%) of the total population were seen with interstitial pulmonary fibrosis. Of these 23 were mesotheliomas. Individual susceptibility is very important when it comes to mesothelioma and bronchial cancer the relatively low frequency of tumors.

P. Hamsagayathri et.al. [15] said that the reliability of disease approach and detection can be improved in the bio medical area if ML is used for pattern detection. They are also impartial in the method of decisions making. Focus should be given on the building hybrid model of algorithms which can be used for disease detection and decision-making processes. Iqbal H. Sarke et.al. [22] proposed that application can be made more intelligent by using machine learning algorithms. The main success of ML solution depends on the data and the algorithm. If the data itself is not good learning. If data has irrelevant features or size of data is not sufficient for training, then the ML models will be useless or will produce undesirable accuracy. Hence effective pre-processing of data and selecting appropriate algorithms from the available diverse learning algorithms are important

A. Al-Anazi et.al. in [28] tried to classify electrofacies and predict permeability distributions by using a nonlinear SVM technique in a very high non-homogeneous sandstone reservoir. The SVM model, discriminant analysis and PNN were compared. Statistical error analysis was used as parameter for evaluation of the model and showed that the SVM method is a better classifier than the neural network methods in classifying the lithology and estimating the permeability. Metaheuristics technique was used by Aakanksha Sharaff et.al. in [25][40] for email classification. Reduction of false-positive was given more emphasizing in the problem of treating spam messages as ham. Extra-treeclassifier was used to classify emails into spam and hermit and metaheuristics-based feature selection methods was used.

Rinkal Keniya et. al. used data from more than 230 diseases and claimed that the weighted KNN gave an accuracy of 93.5 %. The paper also suggested that the model can play the role of the doctor for the early diagnosis of a disease [26]. Jit Kong Cheong et.al. tested the validity of miRNA-based molecular diagnostics for early disease detection. Cancer screening process is more cost effective with the help of tests like circulatory miRNA. Recent advancement in point of care testing is also discussed [27]. Fatih Demir et.al. used a deep learning model called DeepCovNet to detect COVID-19 from the X-ray of patients. SVM classifier and kernel function was optimized using Bayesian algorithm. 99.75 accuracy was obtained by the proposed method [28]. Rajendrani Mukherjee et.al. used KNN classifier for heart disease prediction. The paper proposed that KNN coupled with LASSO (Least Absolute Shrinkage and Selection Operator) gave better results than only KNN [29]. Hery Harjono Muljo et.al. makes use of a dual dataset technique to detect clusters of lung diseases. DenseNet-121 gave an AUC of an average 82.16% with highest AUC of 99.99% in the Viral Pneumonia cluster [30].

METHODOLOGY

DESCRIPTION, PREDICTION, PRESCRIPTION (D.P.P). DESCRIPTION

The Materials and Methods used is called as D.P.P Methodology of Analytics i.e., Description, Prediction, Prescription (D.P.P). Description answers to the question that "What is going on?".[2] In this we find out what the data is trying to tell us. We try to build a story out of the data. We do so by finding out central tendency and plotting graphs, which helps us to visualize the data and to get a border perspective of the data. Prediction answers to the question "What is going to happen?".[3] On the basis of the past knowledge of a process that we gain from the data available to us we try to predict how the process is going to behave in future. Prescription answers to the question that "What should I do". In our case if we don't want to be diagnosed with MM what prevention possible if I know which factors are responsible to diagnosed someone with MM. Figure 1 shows the flow of steps taken in D.P.P Methodology.

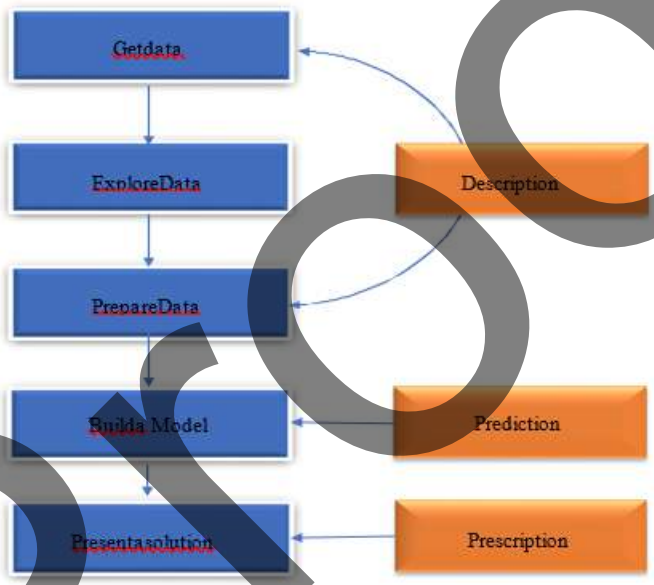

FIGURE 1. D. P. P Methodology Flow

DATA DESCRIPTION

GET DATA

The data used in this study was taken from UCI Machine learning repository. The unique part about this dataset is that it is real dataset taken from patient reports from the hospitals. The dataset was prepared at Dicle University of Medicine in Turkey. This dataset has three hundred and twenty- four Mesothelioma patient data.

These data were examined, and all the features are considered to be more effective than other factors backed by doctor's guidance. Table 1 show the characteristics of data used. Link of data set used: https://archive.ics.uci.edu/ml/datasets/Mesothelioma%C3%A2%E2%82%AC%E2%84%A2s+d isease+data+set+

TABLE 1. Characteristics of Data

Data set Characteristics	Multivariate		Number of Instances	324
Attribute Characteristics	Numerical and	Categorical	Number of Attributes:	35

EXPLORING DATA

The data is multivariate and contains both numerical and categorical features. All features are either of type float or int. No column contains NULL values or is of string data type. The no of rows in each column are equal i.e., 324.The central tendency of all the features were calculated and after analysis it was found that not all numerical features are normally distributed some are skewed to right or left. e.g., Cell Count (WBC) show skewness towards right while age is normally distributed. Also, some categorical features show high variance, e.g., pleural effusion while some features are equally distributed e.g., performance status [4].

Target imbalance was also found in the class of diagnosis feature. 70% of the data was of healthy person and 30% of the data was of MM patients.

After plotting the features in a pair plot and categorizing them on the basis of class of diagnosis it was found that no features can linearly separate the healthy from MM patients in 2-Dfeatures space. Both the classes were found overlapping on each other [16]. Figure 12 density curve of age gender habit of cigarette and pain in chest with respect of class of diagnosis.

To deal with this problem we need to project the features in higher dimensions so that they are linearly separable. This is where machine learning algorithm comes in to play [23][39].

PREPARE DATA

Two sample student t-test is used for testing hypotheses. It was used to formulate the null hypothesis, which states that the mean of respective features of the two samples: healthy and diseased patients in our dataset is equal to mean of the two samples in the population. Alpha value of 0.05 was used as a threshold to reject the null hypothesis [31]. After doing the test following features were rejected: 'age', 'gender', 'type of MM', 'diagnosis method.
Equation 1 show formula for p-value and equation 2 show formula for statistics.

$$Z = \frac{X\hat{} - X0}{\left(\left(\frac{\sqrt{X0(1-X0)}}{n}\right)\right)} \quad (1)$$

Where $\hat{X}$ = Proportion of Sample, X0= assumed population proportion in the null hypothesis and n is the total no. of samples.

$$t = \frac{\bar{X}1 - X2}{SE} \quad (2)$$

Where $\bar{X}1$ is sample Amean and $\bar{x}2$ is sample B mean and *SE* is pooled or unspooled estimated standard error.

As there was also target imbalance synthetic data was generated for minority class was up- sampled to get rid of the imbalance data. Figure 2 show before and after of dealing with target imbalance.

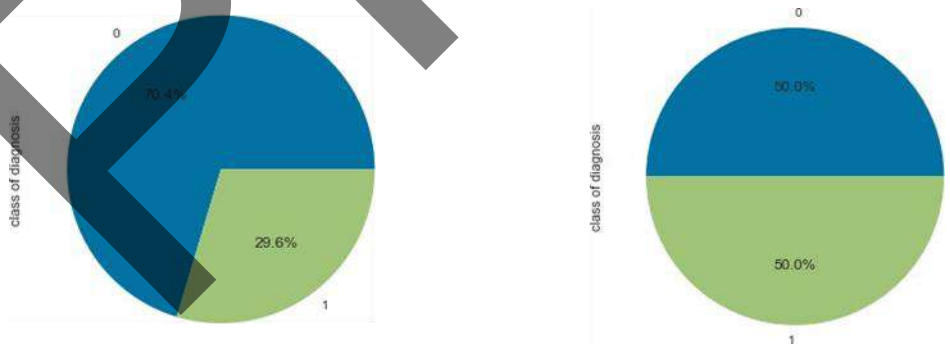

FIGURE 2. Before and after dealing with

After removing high cardinality features like ‘city,’ ’habit of cigarette,’ removing outliers, applying transformation, and normalizing the data.

PREDICTION

MODEL BUILDING

As our data contains imbalance classes, we decided AUC (Area under Roc curve) as the main evaluation parameter for all machine learning algorithms [39]. After training various algorithms and finding out the Accuracy, AUC, Recall, Precision, F1 score, Kappa, MCC (Matthew's correlation coefficient) and sorting them in descending order of AUC following table was obtained. Figure 3 show the snapshot of the table.

	Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC	TT (Sec)
et	Extra Trees Classifier	0.8909	0.9289	0.8314	0.9316	0.8737	0.7790	0.7880	0.0610
rf	Random Forest Classifier	0.8782	0.9200	0.8319	0.9119	0.8621	0.7538	0.7648	0.0720
gbc	Gradient Boosting Classifier	0.8515	0.9177	0.8457	0.8423	0.8388	0.7013	0.7078	0.0340
lightgbm	Light Gradient Boosting Machine	0.8351	0.9106	0.8457	0.8175	0.8272	0.6694	0.6767	0.0180
ada	Ada Boost Classifier	0.8153	0.8660	0.8181	0.7975	0.8034	0.6292	0.6363	0.0320

FIGURE 3. Different Models estimators score for our data

From the above table it is clear that Extra Trees Classifier is on the top with AUC score of 0.9289 followed by Random Forest classifiers, Gradient Boosting Classifier and Light Gradient Boosting Machine.

EXPERIMENTAL RESULTS

EXTRA TREES CLASSIFIER

After building the model using Extra Trees Classifier gave Accuracy of 0.8909, AUC of 0.9289.Recall of 0.8314, Precision of 0.9316, and F1score of 0.8737 on doing 10 folds cross validation.

PRECISION RECALL CURVE (PRC) FOR EXTRA TREES CLASSIFIER

After plotting precision recall curve for Extra Trees Classifier, it was found that trade of between them start Recall = 0.8 and after that with increasing recall the precision falls following a step pattern and ultimately reaches to 0.6 when Recall = 1. The average precision is 0.95. See below Figure 4 which show Precision Recall curve.

ROC CURVE FOR EXTRA TREE CLASSIFIER

After plotting the AUC curve, it was found that AUC for class 0 (healthy) is 0.92 and for class 1(diseased) is 0.92. See following Figure 5 showing ROC curve for Extra tree classifier:

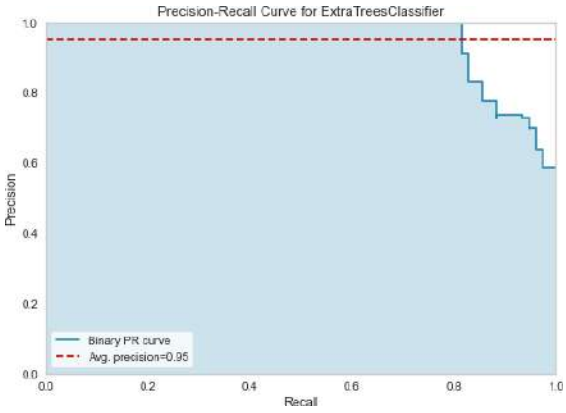

FIGURE 4. Precision Recall Curve

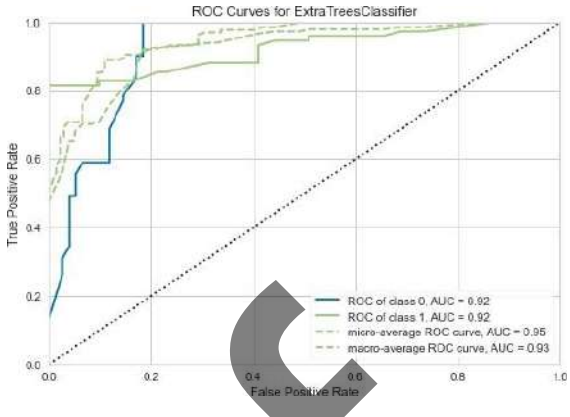

FIGURE 5. ROC Curve

LEARNING CURVE FOR EXTRA TREE CLASSIFIER

In the learning curve training score seems to be constant with increasing training instances where as the cross-validation score has a steady increase with increase in training instances which is ideal for any algorithm to perform well [35]. See Figure 6 showing Learning curve:

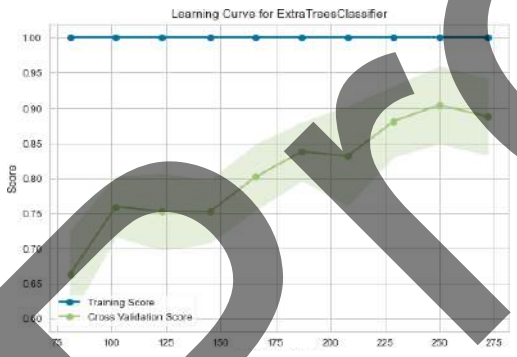

FIGURE 6. Learning Curve

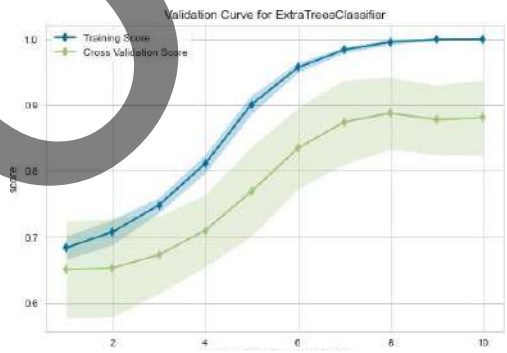

FIGURE 7. Validation Curve

VALIDATION CURVE FOR EXTRA TREE CLASSIFIER

From the validation curve it was the training score, and the cross-validation score are almost identical which is ideal for any algorithm [36].See Figure 7showingvalidationcurve:

CONFUSION MATRIX

From the confusion matrix it is evident that the model Extra Trees Classifier is very well at predicting healthy patients with only 1 miss classification whereas the model is good at predicting diseased patients with 14 miss classification. Following Figure 8 shows confusion matrix.

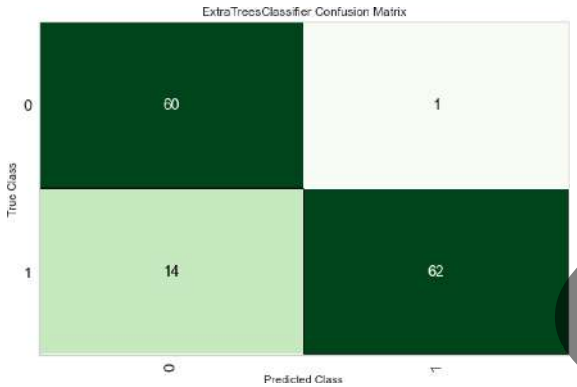

FIGURE 8. Confusion matrix

ENSEMBLE LEARNING MODEL

Though the Extra Trees Classifier gave a satisfactory result we tried ensemble model techniques like boosting, bagging, blending, and stacking to see whether if the results can be improved or not and to achieve the goal of building a more generalized model [14].

BOOSTING EXTRA TREE CLASSIFIER

Boosting is a technique in which a strong classifier is generated from weak classifiers. Each weak classifier tries to correct the mistake of its previous weak classifier [37]. This process is continued until all the predictions are correct or maximum number of models are added. 0.9318 AUC score was obtained after boosting Extra tree Classifier and doing 10 folds cross validation.

BAGGING EXTRA TREE CLASSIFIER

Bagging is a technique which used row sampling with replacement to train models and a voting mechanism to aggregate the results of all the models and make prediction [37]. 0.9289 AUC score was obtained after bagging Extra tree Classifier and doing 10 folds cross validation.

BLENDED MODELING TECHNIQUE

Blending is a technique in which a small portion of train set called validation set is used to make prediction. The validation set and its prediction are used to train another model [38]. This model is then used for final prediction. 0.9254 AUC score was obtained after blending Random Forest, Extra Trees, Light Gradient Boosting Machine and Gradient Boosting and doing 10 folds cross validation.

STACKING

Stacking is a technique in where train data is split into n-fold and a level 1 model is fitted on the n-1 parts and predication are made on nth pj art. Prediction from train set is feed as features for the second level and the second level model is used to make the prediction on the test set [24]. 0.9088 AUC score was obtained after stacking Random Forest, Extra Trees, Light Gradient Boosting Machine and Gradient Boosting and doing 10 folds cross validation.

COMPARATIVE ANALYSIS MODELING

Figure 9 show Confusion Matrix for Extra tree classifier, boosted, bagged, blended, and stacked model.

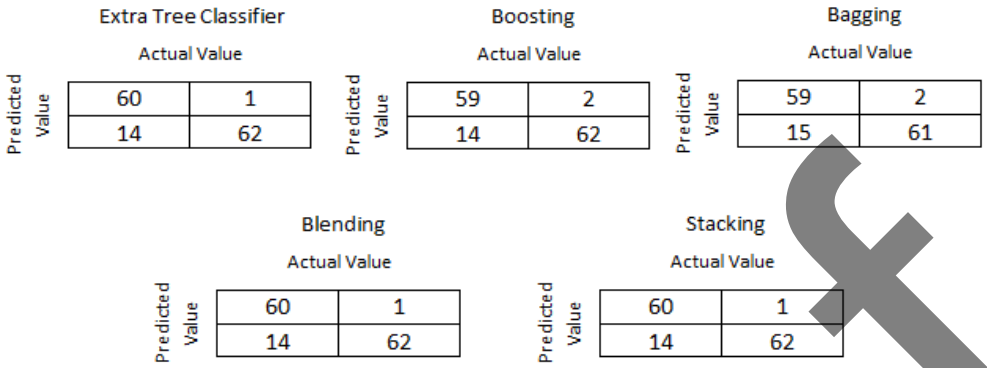

FIGURE 9. Confusion Matrix for Extra tree classifier, boosted, bagged, blended, and stacked model.

From the above confusion matrix, it is evident that Extra Trees Classifier, blended and staked model show better result than the other ensemble models. Fig 10 Show AUC curve comparison.

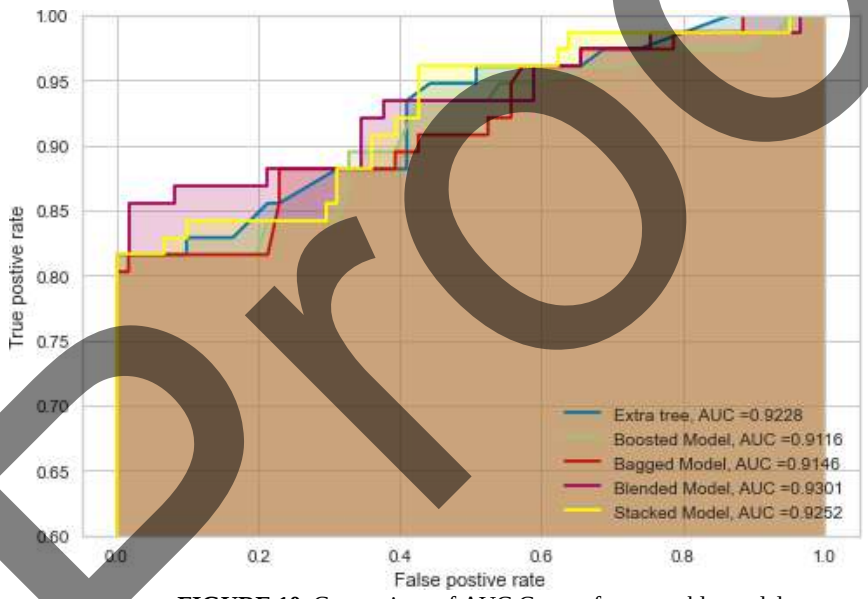

FIGURE 10. Comparison of AUC Curves for ensemble models

From the above Figure 10 it is evident that the Blended model has the larger AUC that the other models followed by Extra tree classifier and Stacked model.

DISCUSSION & CONCLUSION

In Panayiotis Petousis et al [9] the average area (AUC) was above 0.75. In our case the average AUC is above 0.90. From the above figure the top 2 models with best AUC are Blended model and Extra tree classifier. They performed well for both training set and test set. There is confusion matrix also gave a satisfactory result. It was found that all the algorithms use in the study gave a good result and can be used to help diagnosis of MM's diseases. And based on the data analysis of the patients it validated the fact that 'keep side,' 'city,' 'duration of symptoms' is the most responsible for someone to classify with MM disease [21].

The models can be evaluated on the real data to find out how good they perform. Other approaches like AI and deep learning can be used to get more better results.

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Automatic Detection And Classification Of Plant Leaf Diseases Using Image Processing: A Survey

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Abstract. Awareness of plant disease is a key task in the agriculture field. Early diagnosis of plant leaf diseases may aid farmers in avoiding losses caused by a variety of plant leaf diseases. Plant leaf diseases are detected through image processing by examining the trends of leaf photographs over time. Furthermore, due mostly to the worldwide pandemic coronavirus, global potato consumption is increasing significantly. Potato infections, on the other hand, are the leading cause of crop quality and availability decreases. Incorrect disease classification and late detection will aggravate plant conditions greatly. Fortunately, many plant diseases may be identified using leaf features. Manually watching and detecting leaf diseases is a time-consuming, expensive, and labor-intensive approach. As a consequence, utilising an automated image processing system to identify diseases is preferred. image enhancement, image pre-processing, segmentation techniques, feature extraction, and other image processing techniques, as well as image classification are accessible for identifying plant leaf diseases. This paper presents an overview of the various computer vision algorithms used to diagnose plant leaf diseases. Some deep learning algorithms are investigated.Automatic Detection of Plant Leaf Diseases Using Image Processing: A Survey.

INTRODUCTION

The leaves of agricultural crops [1], have an important function in that they convey information regarding the quantity and quality of horticulture produce. Food production is impacted by a number of variables, including climate change, the prevalence of weeds, and sterility in the soil. Then there is the issue of plant and leaf disease, which is a global threat to the production of many different agricultural products and an economic drain[2]. If plant diseases, bacteria, or viruses are not properly diagnosed, inadequate amounts of pesticides and fungicides will be applied to the plants. As a result, plant diseases have received a significant amount of attention from the scientific community, with particular emphasis placed on the biological characteristics of diseases. The most cutting-edge technology is put to use in precision farming in order to improve the effectiveness of decision-making. When it is necessary, the visual inspections that are performed by professionals and the biological examination are often done via plant diagnosis. This procedure, on the other hand, often requires a lot of time and is inefficient regarding cost. It is vital to identify plant illnesses using sophisticated and astute methods in order to find solutions for these problems.

The presence of plant diseases has a detrimental effect on the amount of food that can be produced through agriculture. Increased food insecurity will result if plant diseases are not identified and treated in a timely manner[3][1] The early diagnosis of plant diseases is the foundation for successful prevention and control of these pests, and these inspections also play an essential part in the management and decision-making processes involved in agricultural production. Detection of plant diseases has been an increasingly important concern in recent years.

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FIGURE 1. Bacterial disease on leaf

Defects or marks may often be seen on the leaves, stems, flowers, or fruits of plants that have been afflicted with disease. In general, each illness or pest situation shows a distinctive visual pattern that may be utilized to detect anomalies in a particular individual. In most cases, the leaves of plants are the main source for diagnosing plant illnesses, and the leaves are also where the majority of the symptoms of plant diseases may first begin to develop[4].

In the majority of instances, agricultural production specialists are brought in to diagnose on-site, or farmers utilize their years of knowledge to identify infections and diseases that affect fruit trees. This technique is not only reliant on personal opinion, but also cumbersome, time-consuming, and ineffective.

During the identification procedure, farmers with less expertise are more likely to make mistakes in judgment and then use medications without proper testing. The quality as well as production will also cause environmental damage that will result in unnecessary economic losses. Image processing methodologies for the detection of plant diseases have emerged as a significant as well as active area of study in response to these challenges[5].

In a great number of research, traditional machine learning (ML) techniques have been used in order to carry out agricultural tasks [6][7]. On the other hand, in recent years, deep learning (DL), which is a subset of machine learning, has shown to be astonishingly successful for the detection, identification, and categorization of real-world objects. As a result, there has been a shift in the focus of farming systems towards DL-based solutions. The results that have been achieved using DL approaches to execute agricultural tasks such as crop/weed discrimination, fruit harvesting, as well as plant identification have been considered to be state-of-the-art. In a similar vein, current research has also concentrated on the detection of plant diseases, which is another crucial agricultural concern[1].

In order to conduct plant disease classification, a number of cutting-edge DL models have been implemented, and for this purpose, well-known DL architecture have been used. In addition, several researchers came up with modified versions of DL algorithms in order to increase the accuracy of disease categorization in a number of plant species.

PLANT DISEASE IDENTIFICATION

Early identification of plant diseases is crucial since it decreases agricultural productivity. Image processing technologies enable automatic sickness identification, but manual disease diagnosis is tedious and costly. Plant leaf diseases are a significant source of worry in agriculture. Farmers must diagnose plant leaf diseases as soon as feasible in order to minimise the losses caused by these diseases. Plant leaf diseases may be identified via image processing by analysing the patterns of leaf images over time. It will take a lot of time, funds, effort, and more to observe and identify leaf diseases manually. It is best to use an automated image - processing system to identify abnormalities. When using various image methods to identify plant leaf diseases, operations such as image acquisition, preprocessing, segmentation, extraction of features, and classification are essential[8].

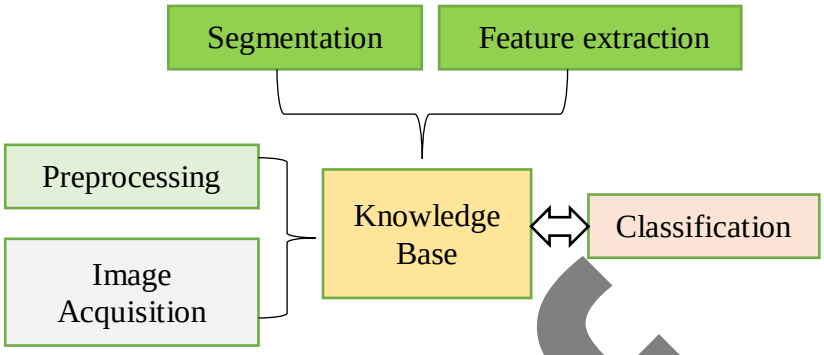

FIGURE 2. Image processing is a series of fundamental steps

Fig. 2 Shows image processing's fundamental processes Plant disease detection is the knowledge foundation for our problem. Preprocessed photos reduce noise as well as other interfering elements while also working to improve the image quality to ensure accurate detection. Because it removes the items of our interest for detection, segmentation is a key step of the image recognition system. The feature extraction process eliminates irrelevant data from the data collection. The next phase is classification, which involves classifying the provided picture based on our interests. To determine if the supplied picture belongs to the sickness or healthy category, click here. As a representational learning method, generative representations are used in deep learning. Encoders, decoders, or some combination of the two: Encoders analyze raw data in search of patterns that can be used to generate compact, understandable representations. Decoders use these representations to create high-resolution data. The data produced is either fresh instances or descriptive knowledge.

TYPES OF PLANT DISEASES

Fungal diseases, Bacterial illnesses, and viral diseases are all examples of plant diseases. [8].

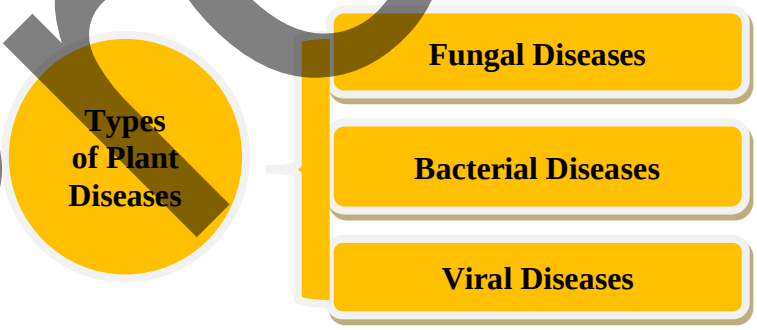

FIGURE 3. Types of Plant Diseases

FUNGAL DISEASES

Fungal diseases are caused by fungus. Fungi, which may be single cells or multicellular organisms, infect plants. Fungi cause the vast majority of plant diseases. When fungus is present, the whole plant is coated with fungus. To treat fungal infections, several fungicides may be employed. Fungi diseases are identified by their morphology.

FIGURE 4. Fungal disease on leaf-early blight

BACTERIAL DISEASES

Bacterial blight, Crown gall, Wilts, and Soft patches are only few of the infectious diseases that may be caused by bacteria. A telltale indication of this disease is the appearance of pale green spots on the leaf. It seems as if there is no one living there.

VIRAL DISEASES

Because of their very minute size, viruses cannot be recognised by using a light microscope to examine them. Viruses are able to invade cells and take control of the machinery inside them, which forces the host to manufacture an enormous number of copies of the virus. Viruses may cause a variety of diseases, including leaf curl, leaf crumple, and leaf roll, to name just a few. It is notoriously difficult to identify the virus that is responsible for viral infections. It's possible that viral infections will cause the leaves to become wrinkled and frizzy.

FIGURE 5. Viral Disease on leaf

CAUSES OF PLANT DISEASES

Both biological and non-biological agents may infect plants, which can lead to the development of disease. [9]. Biological agents, which include fungus, bacteria, as well as viruses, are the root cause of a wide variety of diseases. Abiotic problems include a lack of nutrients, an acidic soil pH, insufficient light, and severe weather conditions, all of which may result in sickness.. [8].

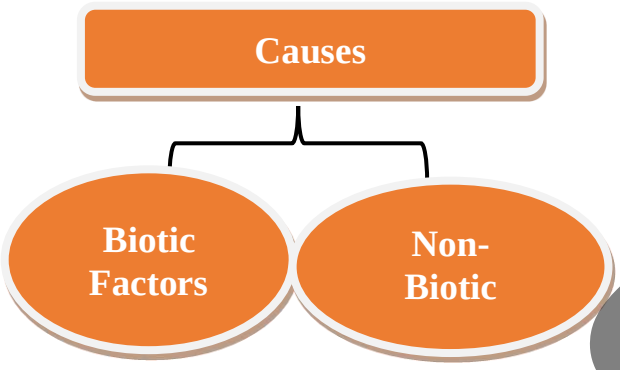

FIGURE 6. Causes of Plant Diseases

DEEP LEARNING

According to deep learning, reliable results can be achieved by simulating human tendencies to obtain knowledge through experience, which is a subset of machine learning. In order to teach a computer's architecture how to classify tasks based on the information it has at its disposal, deep learning has been developed. This method makes use of readily available resources including such text, images, and audio. Convolution neural networks are among those that are used the most often when it comes to deep neural networks. Instead of manually extracting characteristics, as is done in machine learning, these networks learn features from the photos or text that they are given. As a direct consequence of this, neural networks now possess an accuracy level that is noticeably higher than that of humans. The machines benefit from greater generalized knowledge since it makes their work simpler and more efficient. Most traditional methods of learning make use of shallow networks to symbolize a limited number of functions. Deep learning, on the other hand, leverages compact representations of a far wider range of functions than these traditional methods[10].

Learning via deep learning takes use of many different information processing processes organized in hierarchical constructs for the purpose of feature representation and pattern categorization. It is a method of machine learning that has found use in a variety of academic fields, including optimization, graphical modeling, pattern recognition, neural networks, and signal processing. The most significant benefits of deep learning come from its ability to tackle problems that traditional methods of artificial intelligence simply cannot.

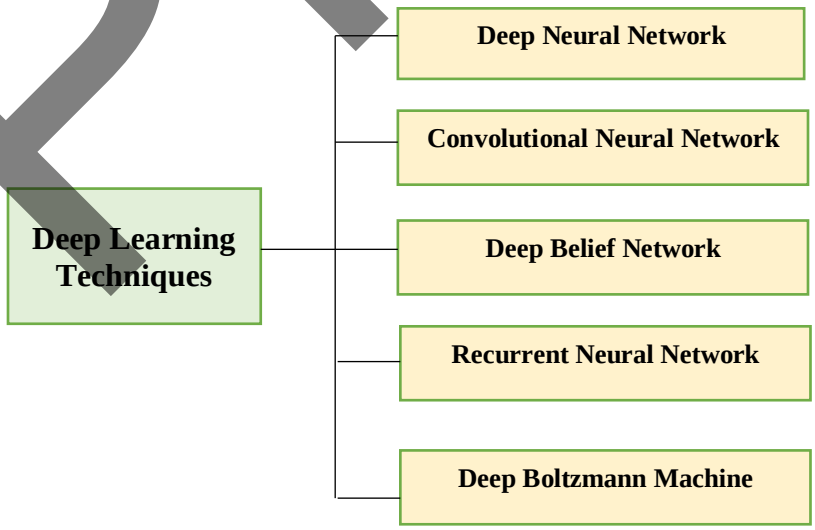

FIGURE 7. View of Deep Learning techniques

The following is a description of some of the methods that have been discussed previously [11]:

- **Deep convolutional network (CNN):** is a kind that falls within the feed-forward multilayer NN paradigm. Convolutional numerous layers are used, followed by a few layers that are totally coupled in this process.

✓ **Advantage:** When opposed to its predecessors, CNN's most notable strength is in the fact that it can recognise significant characteristics on its own, without the need for any kind of oversight from a human.

✓ **limitation:** When an operation such as maxpool is performed, a CNN experiences a considerable slowdown. If the computer doesn't have a decent GPU, the training procedure for a CNN that has several layers will take a very long time. In order to analyse the data and train the neural network, a ConvNet needs a very big database.

- **Deep neural network (DNN):** illustrates a multilayer perceptron that has numerous layers that are hidden from view. The weights are completely connected to one another and are initialized through a process that combines supervised as well as unsupervised pre-training.

✓ **Advantage:** Models are able to become more effective at learning difficult characteristics as well as carrying out more demanding computational tasks because to the several layers that are included in deep neural networks. This allows the models to conduct a greater number of complicated operations concurrently.

✓ **limitation:** In order for it to work more effectively than other methods, a very huge quantity of data is required. Due of the complicated data models, training it is an incredibly costly endeavour. In addition, deep learning calls for the use of pricey GPUs and hundreds of different computers. Because of this, the costs to the consumers will rise.

- **Restricted Boltzmann machine (RBM):** depicts a specific BM that is made up of a visible unit's layer as well as a hidden unit's layer but does not have any hidden-hidden or visible-visible links between the two layers.

✓ **Advantage:** expressive enough to represent any distribution while maintaining a high level of computing efficiency. Due to the limits placed on the connections between nodes, the regular Boltzmann Machine can't compete with the speed of this machine. Activations of the hidden layer might be utilised as input to other models as helpful characteristics in an effort to enhance performance.

✓ **limitation:** In the case of RBM, adjusting the weights is not as clean as it is in the case of the backpropagation algorithm. Because the energy gradient function is so complex to compute, training the constrained Boltzmann machine may be challenging.

- **Deep belief network (DBN):** a probabilistic generating technique that consists of numerous layers of stochastic variables that are hidden from view and represents. The first two layers, which are on top, feature connections that are symmetric and undirected. The layer directly above them provides the lower levels with top-down connections that are directed downward.

✓ **Advantage:** Utilizing hidden layers in a productive manner is easy with DBN (greater performance improvement by the addition of layers in comparison to multilayer perceptrons). Even when dealing with enormous amounts of data, DBN delivers the highest quality performance outcomes.

✓ **limitation:** DBN requires huge data to perform better techniques. DBN is difficult to be used by less skilled people. DBN requires classifiers to grasp the output. Hundreds of machines are required.

- **Deep auto-encoder:** depicts a DNN whose output consists of the same data that was used to train it. Autoencoders are put to use to assist in the reduction of noise in the data. Autoencoders enable you to minimise dimensionality as well as concentrate solely on regions that have actual value by compression input data, encoding it, and afterwards rebuilding it as an output.
- **Advantage:** The autoencoder's usefulness lies in the fact that it filters out noise from the input signal, leaving behind just a description of the signal's high-value components.
- **limitation:** Insufficient data for training purposes. Insufficient comprehension of critical factors. When this happens, algorithms become too specialised, and the bottleneck layer becomes excessively constrained.

CONVOLUTIONAL NEURAL NETWORK (CNN)

A convolutional neural network (CNN) [12] is the evaluation of visual scenes is carried out using a type of deep learning. Each or more hidden layers extract the properties of videos or images, while a fully associated layer produces the desired output. In addition, it produces an output layer that is fully linked. On the other hand, the picture that is shown on the computer is a three-dimensional array (width by height by depth) that contains values that range from 0 to 255. It is nothing more than a collection of coloured pixels; if there is only one channel, the picture will be in grayscale, black, and white. In addition, each channel represents one of three colours (assuming the picture is RGB)[13]. Due to its ability to provide precise findings, CNN Deep Network has shown remarkable success in a number of contests relating to image processing[14], See Figure 8 for an illustration of CNN's layered structure. CNN

is organized in a hierarchical way. The development of prediction models for the early diagnosis of plant diseases was facilitated by deep learning. [15]. These well-known techniques of pattern analysis have been employed in the research, including Modified CNN [16], GoogleNet, Resnet50, Resnet50, as well as efficient.

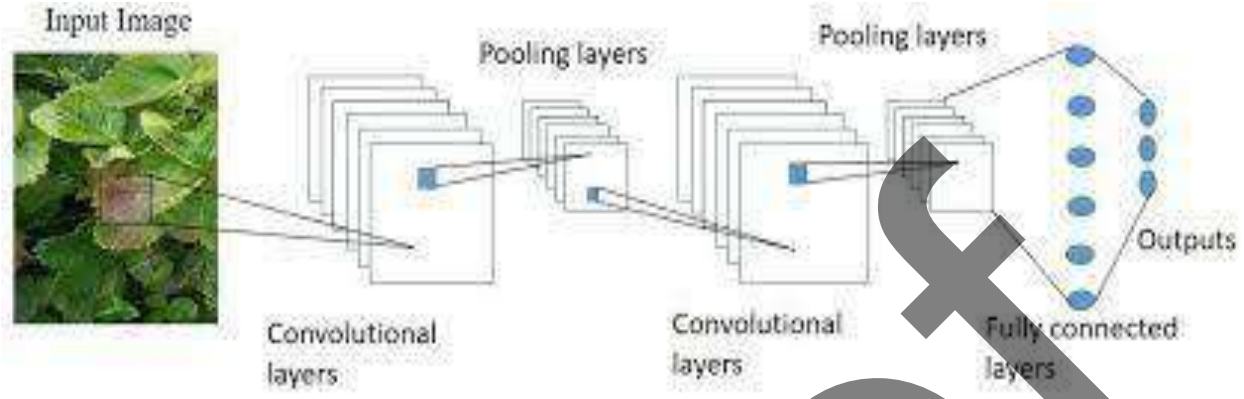

FIGURE 8. Architecture of a traditional CNN

The Convolutional, Activating, Pooling, and Fully Connected Layers of CNN are the four basic building blocks of the algorithm.

CONVOLUTIONAL LAYER

In the convolutional layer of the neural network, a filter that is called a kernel is used to detect whether or not patterns are present in the original picture that is being fed into the network. If patterns are found, then other filters may be used to extract a variety of characteristics. As a result of the need to scan the entire image and perform the necessary arithmetic to extract features, the filter was designed to be extremely small. During the periodic training phase, the filter settings are reset, and after a certain number of epochs have passed since the network has been trained (epochs indicate that all training samples have been submitted concurrently), the filters begin searching for distinct properties in the picture. The initial hidden layers are used to extract characteristics that are straightforward and obvious, such as edges going in a variety of directions. As we go further into the network's hidden tiers, there is a corresponding increase in the difficulty of the properties that need to be detected and retrieved.

POOLING LAYER

There is a goal of reducing the size of activation maps through pooling. You don't have to do this, but if you do, you'll avoid the overfitting scenario. Clustering is a basic concept, in which enormous arrays are reduced in size.

FULLY-CONNECTED LAYER

Each node from the previous layer is linked to every other node in this layer. It is here that all of the information is sorted and categorised to its final form.

ReLu activation function is connected to the output of a conv layer to build a network model of a network from an image input. An assembly layer receives the result of the function's output after a series of convolutions. A series of iterations leads to the creation of trainable classifiers. Each class we wish to train on has a probability assigned to it in a fully linked layer, which receives its output. From 0 to 1, the input range is available. Edges and curves can be identified by using neurons as image processing filters in the convolution layer. The depth of the data network is taken into consideration when creating the filter. In the conv layer, each filter will have its own picture attributes, such as vertical and horizontal borders as well as colours, textures, and densities.

An image's feature extraction array is made up of all neurons from the whole picture. Pooling layer is placed between consecutive convolutional layers to minimise overfitting and condense the quantity of input. Pooling layer's primary job is to reduce the size of an image by shrinking it, if the input is a picture. Compressing a picture removes information that isn't necessary, so we may eliminate it.

Many different CNN structures have been created throughout time to deal with real-world challenges and achieve high accuracy. CNN may be used in the medical profession to diagnose disorders such as the ones listed below utilizing various models developed using CNN:

ALEX NET

In the ImageNet competition, Alex Krizhevsky et al. (2012) constructed a convolutional neural network that achieved an accuracy of 84.6%. There are eight levels in the network, with five Conv and three FC layers. In addition, it takes 12.90[17]. ms to learn. The AlexNet architecture is seen in Figure 9. The size dimension is shown in this image.

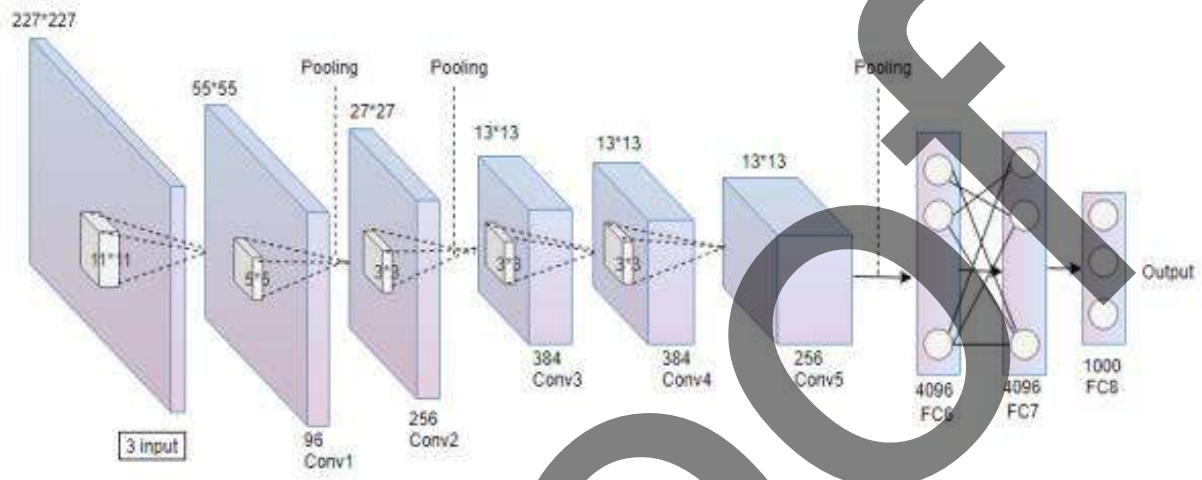

FIGURE 9. AlexNet architecture.

VGG16

The model created by Karen et al. (2014) has a 92.7 percent accuracy rate in ImageNet's top five tests. There are three FC layers, thirteen Conv layers, and sixteen weights in the network. In addition, it takes 16.55 ms to learn [18]. A diagram of the VGG16 architecture is shown in Figure 10.

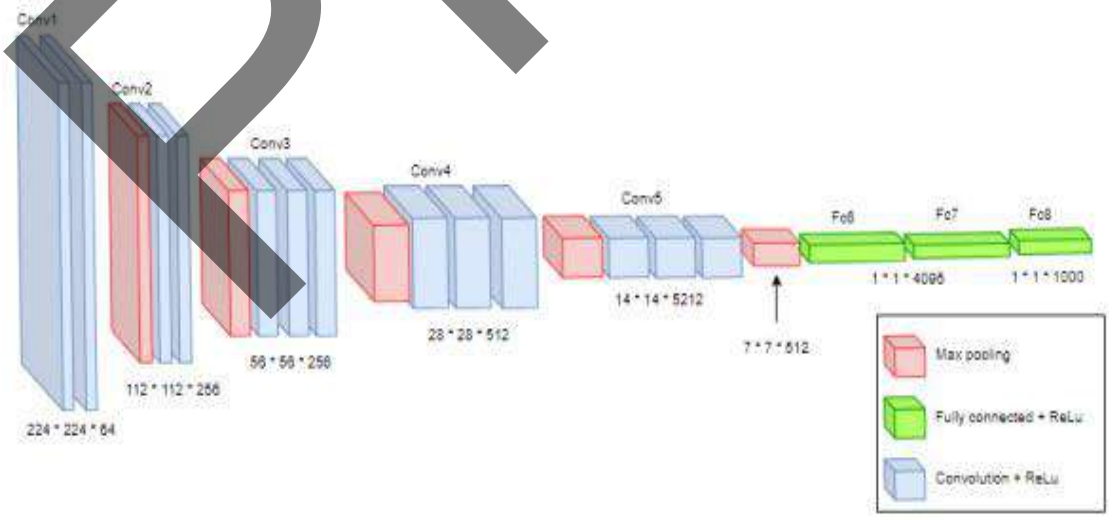

FIGURE 10. VGG16 architecture

GOOGLE NET

GoogleNet, the initial iteration of the Inception network, is a CNN created in 2014. In all, there are 22 levels, 21 Conv and 1 FC, plus 27 layers of pooling. The overall number of conception modules is nine. Both the inception and global average pooling layers of the inception model are coupled. The time it takes to master it is 12.98 ms. [19]. A diagram of the GoogleNet architecture is seen in Fig. 11.

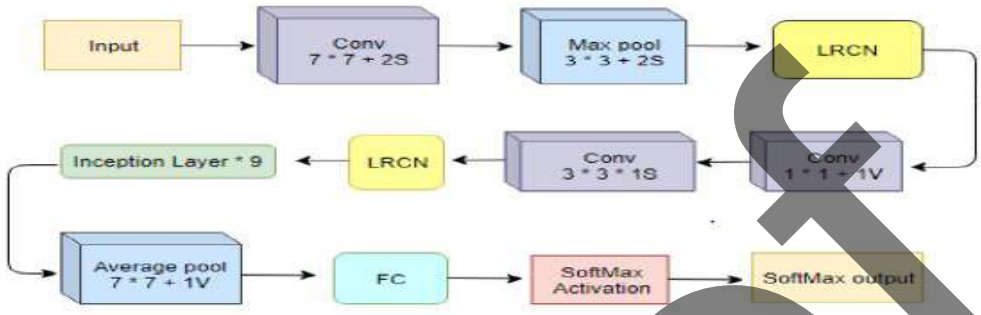

FIGURE 11. GoogleNet architecture.

RES NET50

ResNet50 is a CNN that was built in the year 2015; this network has a total of 50 layers, of which 49 are convolutions and 1 is a fully connected layer. There are three convolution layers in each convolution block. [19]. An example of the ResNet50 architecture may be seen in figure 12, below.

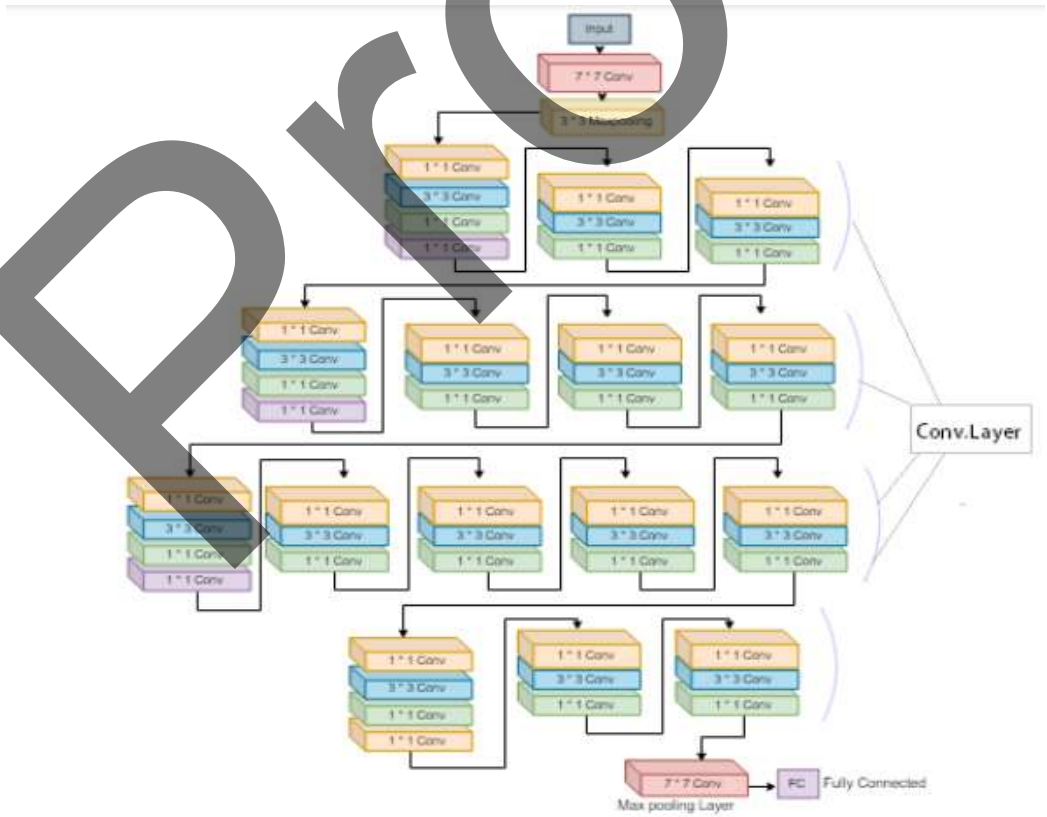

FIGURE 12. ResNet50 architecture.

EFFICIENTNET

EfficientNet is a technique and architecture for scaling CNNs that uses a compound coefficient to scale all dimensions of depth, breadth, as well as resolution in a convolutional neural network equally. This article from AutoML MNAS (2019) presents a CNN approach that was created by the authors. This method compound coefficient is used to scale all aspects of depth, broadness, and resolution.[20]. The EfficientNet architecture is depicted in Figure 13.

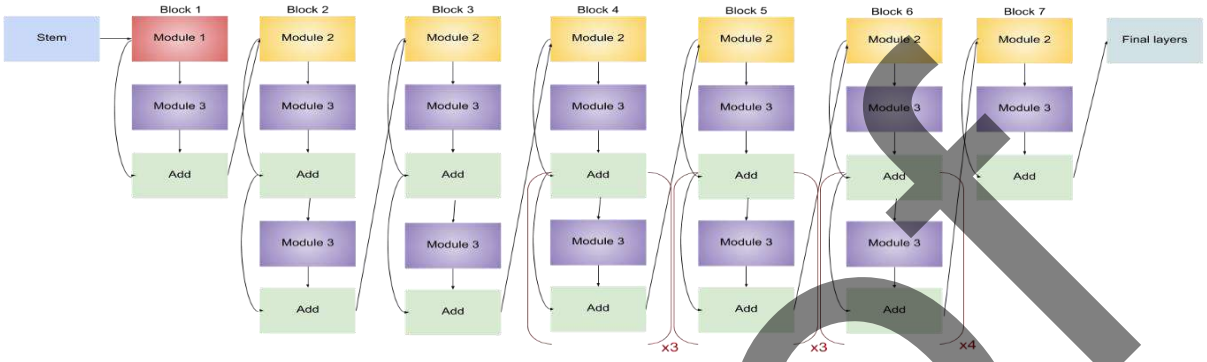

FIGURE 13. The architecture of EfficientNet.

LITERATURE REVIEW

A significant source of output reductions and financial losses in agriculture can be traced back to plant diseases. It is a difficult task that necessitates knowledge in order to correctly identify illness. Colorful dots or streaks can be seen on plant leaves as a sign of disease or its symptoms. Microbes like fungi, bacteria, and viruses frequently cause plant diseases. By physically evaluating this same plants on the site, an expert's human eye identified as well as method of trying to treat plant ailments. This method is expensive, slow, and low cost. This is why the need for partially or entirely automated plant disease detection systems is an important emerging subject of research. This section discusses current research in this topic as well as the methodologies used.

Throughout this investigation, four CNN models were combined to enhance plant disease detection [21]An open-source collection of 36258 photos is examined. In 4-CNN models, Inception, Resnet, and Densenet were used, as well as a stacking approach, to evaluate the CNN model's output. When compared to a single Classification algorithm, the stacking method enhanced accuracy by 87 percent.

A DL model suggested in this study can detect leaf pictures and the presence of an illness [22].To associate the accuracy of tomato plant photos acquired from the plant village dataset, pre-trained models such as VGG17 and Dense Net were used. A suggested blending process may aid farmers in the early identification of damaged leaves because to its measured interpretability and accuracy.

Using a collection of plant communities, the researchers [23]utilise DL-suggested models and TL-based models to detect pictures of PDD in types of 38 plant illnesses depending on their inadequacy. The researchers employed eight pre-trained models, including ResNet50, VGG19, and VGG16. According to the findings of their testing, DenseNet provides the best results with 99 percent accuracy.

In this work, [24] the EfficientNet and DenseNet models of DCNNs were used to correctly detect four kinds of Images of diseased apple leaves show a variety of apple plant pathogens. Aside from these, "other illnesses" are also included in the various subcategories. CED, Blurring, as well as Flipping are among of the methods employed in this study to enhance data collection for apple leaf disease. EfficientNetB7 as well as DenseNet architectures are suggested for accuracy of 99.8 percent and 99.75 percent, correspondingly, and to solve the drawbacks of CNNs.

The suggested[25]method, known as the local-based technique, focuses only on the areas on the leaves. The generic global-based image augmentation techniques are utilised in the second step to expand the diversity of the photos in terms of posture, brightness, blur, and noise. The basic CNN model is suggested for plant leaf disease detection utilising enhanced photos in the third step. In this study, the CNN model is suggested. The VGG19 and MobileNet are utilised for comparison and analysis of the suggested method's influence in the first step. They conduct experiments on two types of plants: potato as well as grape, using three CNN models: their CNN model, VGG19, and MobileNet. Potato with grape leaf have accuracy rates of 93.78 percent, 95.56 percent, 77.33 percent, 93.90 percent,

96.30 percent, and 80.00 percent for their CNN, VGG19, and MobileNet models, correspondingly. As a consequence, the suggested local-based picture augmentation approach may improve the prediction performance of all models.

Detecting plant leaf disease[26]has historically been subjective, time-consuming, as well as costly, requiring a large number of individuals and a large amount of knowledge on plant diseases. The agricultural industry is not immune to machine learning. In this paper, we used "Convnets" to identify and classify plant diseases. They obtained PlantViallge data from Kaggle. It includes photos of 15 distinct plant leaf classes from three different plants: potato, pepper, and tomato. They partitioned the dataset into three parts and applied Convnets to each. They obtained 98.3 percent, 98.5 percent, and 95 percent accuracy in detecting potato plant disease, pepper plant disease, and tomato plant disease, respectively. The results of their trials show that their approach is quite accurate at identifying and categorising plant leaf diseases.

Plant disease identification and early diagnosis might be much enhanced using the[27]computer vision deep learning approach suggested in this work. Several visual criteria may be used to identify and diagnose plant diseases. This paper provides a method for classifying potato illnesses using computer vision as well as deep learning. On the Kaggle potato dataset, it trains deep CNN including such ResNet-152 as well as InceptionV3 with 98.34 percent and 95.24 percent accuracy, respectively.

TABLE 1. Comparative analysis of literature study

Author (year)	**Problem**	**Model**	**Dataset**	**Outcome**	**Limitation**
Guan, 2021	plant disease detection	stacking CNN model (Inception, Resnet, Inception Resnet, and Densenet)	open source database of 36258 images[21]	accuracy = 87%	However, despite the model's exceptional performance in evaluating the validation set, it is still not ready for practical use because of its high computational requirements.
Rubini and Kavitha, 2021	disease prediction in crop plants	pretrained models (VGG16 and DenseNet)	Plant Village dataset (tomato leaf images) [22]	VGG16 accuracy = 92% DenseNet accuracy =98.25%	Just one sort of plant was included in the dataset, and it was able to identify the disease that the leaf was infected with.
Chellapandi, Vijayalakshmi and Chopra, 2021	Prevention and early detection of crop disease	DenseNet	Plant Village dataset[23]	accuracy = 99%	This study can further be studied by increasing the types of diseases.
Srinidhi, Sahay and Deeba, 2021	disease diagnosis is time consuming, expensive and based on human scouting.	Deep Convolutional Neural Networks models (EfficientNet and DenseNet), Canny Edge Detection	Apple leaves dataset[24]	EfficientNet B7 accuracy = 99.8% DenseNet accuracy =99.75%	Using stacking, ensembling, and strong testing scheme can lead to even more robust and accurate models in the long run.
Wongbongkotpaisan and Phumeechanya, 2021	plant leaf disease classification, insufficient dataset	three CNN models (CNN model, VGG19 and MobileNet), local-based image augmentation method	potato and grape leaf images[25]	CNN accuracy = 93.78%,93.90% VGG19 accuracy = 95.56%, 96.30% MobileNet accuracy = 77.33%,80.00%	The accuracy was achieved for potato disease was minimum

COMAPRATIVE RESULTS

Here in this section, I have provided the accuracy comparison between various existing model like stacked CNN and some pretrained models that are VGG16, DenseNet, EfficientNet, VGG19 and MobileNet that accurately detect plant disease. These model for the training used various dataset like Plant Village dataset[1], different leaf type dataset[2] and apple leaf dataset[3] etc. Similarly, other kind of plant dataset publicly available. These models used different types of dataset using deep learning models that already shown in above table 1.

To assess the performance of the experimental model, we employ the Accuracy: Accuracy refers to how near or far off a particular set of measurements (observations or readings) are to their actual value, whilst precision refers to how close or scattered the measurements are to each other. Accuracy and precision are sometimes used interchangeably. To put it another way, precision may be thought of as a description of random mistakes as well as a measurement of the statistical variability.

$$Accuracy = \frac{(TP + TN)}{(TP + TN + FP + FN)} \dots (1)$$

Where,

- The term "true positive" refers to an observation that was both anticipated to be positive and was found to be positive.
- The term "false positive" refers to an observation that was projected to be positive but was, in fact, negative.
- The term "true negative" (TN) refers to an observation that both predicts to be negative and really is negative.
- The term "false negative" refers to an observation that was expected to be negative.

TABLE 2. Accuracy Comparison

Models	Accuracy Model
Stacking CNN[21]	87
VGG16 [22]	92
DenseNet[22]	98.25
EfficientNet [24]	99.8
VGG19[25]	96.30
MobileNet[25]	80.00

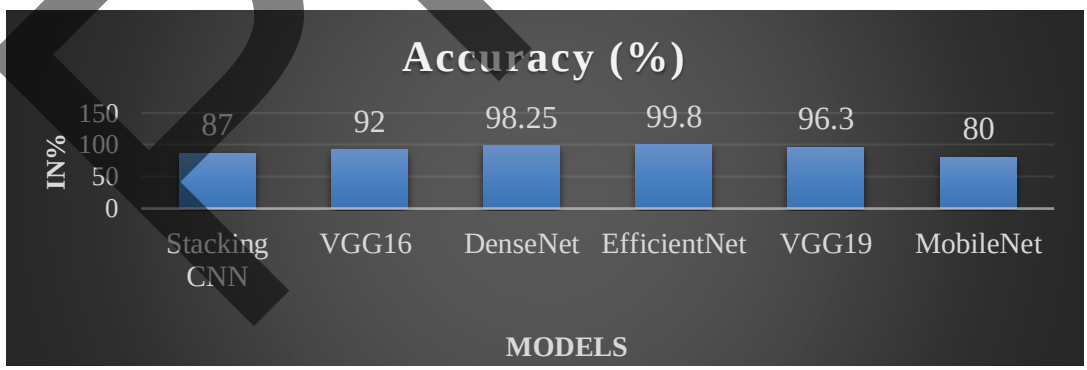

FIGURE 14. Bar graph of Accuracy comparison using different Pre-Trained Models

In above figure 14 and table 2 shows the models accuracy using different deep learning models and datasets that already provided in above. We can see that the CNN model gets 87% accuracy while all pre-trained model shows highest performance for plant disease detection. VGG16 accuracy is 92%, DenseNet accuracy is 98.25%, EfficientNet accuracy is 99.8%, VGG19 accuracy is 96.30% and MobileNet shows 90% accuracy. We can see that the EfficientNet model shows high plant detection rate in comparison to other models.

CONCLUSION

Diseases that affect plants need to be identified as soon as possible since they may reduce agricultural yields. Image processing technologies help in the automated diagnosis of diseases, while manual detection is a challenging endeavour that requires a substantial commitment of money, time, as well as effort. This study's review gives helpful knowledge in the field of agriculture that researchers may use to detect diseases at an early stage. India is an agricultural nation, and the country's crop production rate is a big concern. Less production equals higher food costs and increased hunger for individuals who can't even afford potatoes; consequently, deep learning techniques have produced a technique that will simplify farmer labour to some extent in order to boost agricultural yield rates as well as minimise disease infection in plants. Deep Neural Networks, an area of Artificial intelligence, may be used to diagnose unhealthy plants as well as avoid doing it manually, as well as to give efficient therapy at the bud stage now before it's too late. This study examined various articles and found that Convolution Neural Networks (CNN) are more effective in detecting leaf sickness. It was also demonstrated that CNN had the highest potential efficiency for illness detection.

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Analysis and Optimization of Antenna Technology Based On Impacts of 5G Radiation on Human Health and Environment

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Abstract:-This research article examines the effects of massive MIMO technology, which is a crucial component of the future 5G standard, on human health and the environment. 5G wireless communication systems are planned to deliver simultaneous broadband services to a large number of users at extremely high data rates on the order of hundreds of Mbps to meet the ever-increasing demand for high-speed internet. Current cellular mobile systems' power consumption is increasing at an alarming pace. In the end, this fantastic scenario is to blame for environmental risks and human health issues. There is a clear need for Green 5G Technology that meets both needs: one is to create sophisticated technology to meet societal demands, and the other is to decrease power consumption and electromagnetic radiation in the environment. Researchers have a significant problem in developing low-power devices that also emit low-power signals into the environment to reduce health risks. As a result, it is critical to create new wireless communication technologies that are intended to give improved spectral and energy efficiency. MIMO systems in which both the transmitter and the receiver know the channel (using channel estimate feedback) are contrasted to MIMO systems in which only the receiver knows the channel. Furthermore, the development and maintenance of new technologies connected to 5G technology creates electronic waste and consumes significant resources, both of which have the potential to harm environmental health. According to certain studies, 5G networks are causing damage to birds, which has a cascade impact throughout whole ecosystems. This difference is quantified and analysed across a variety of antenna types and conditions, and a generalizable parametric model is provided to facilitate more realistic design, simulation, and analysis. The positive and negative effects of massive MIMO technology on human health based on ambient radiation are examined in this study, as well as the scope of future research on Green 5G technology.The design and development of a E shaped antenna for wireless applications is presented in this study. On one side of the substrate is a rectangle radiating patch with symmetrical E-shaped slots, and on the other side is a ground plane. The planned tiny antenna is 30 x 30 x 1.68 mm in size. The intended shape, the operating frequency, return loss (S_{11}), Gain and voltage standing wave ratio (VSWR) are calculated. The antenna has five frequency bands ranging from 6 GHz to 10 GHz. At frequencies of 6, 7, 8, 9 and 10 GHz, the estimated return loss values are -14.56dB,-18.26dB, -20.56dB, -25.68dB and -28.98dB respectively. The resonant frequency peaks from 6GHz to 10GHz, the measured VSWR values are 1.4, 1.5, 1.6, 1.7 and 1.8 respectively. The gain is to operate the various frequencies from 6 ,7, 8 , 9 and 10 GHz is obtained ate 4.5, 5.5, 6.5, 7.5 and 7.8dB. The VSWR (between 1 and 2) and S_{11} (below -10dB) values obtained are within the acceptable range for the intended frequency ranges. The antenna has a permittivity of 4.4 and is made from a FR4 substrate. The VNA tool is used to calculate the performance characteristics of the constructed antenna shape.

INTRODUCTION

Microstrip patch antennas have made significant progress in the area of wireless communication in recent years. They offer a number of benefits, including low weight, cheap cost, smaller size, quick manufacturing, fast data rates, and the capacity to operate in multiband and wideband. They may be printed directly on a PCB and are becoming more common in mobile phones. The design technique for microstrip antennas is getting more challenging as the need for operational bands grows. In order to be used in miniature portable devices, microstrip antennas must be small. In order to create microstrip antennas, patches in the forms of rectangles, squares, circles, triangles, donuts,

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and dipoles are used. Micro strip antennas are widely used in a range of applications because to their low profile, low cost, and ease of fabrication. These antennas are required in a variety of applications such as mobile and satellite communication, GPS, and wireless applications, among others. In this study, the performance of several E-shaped micro strip patch antennas is compared. With the advancement of technology, satellite communication has entered our daily life. Customer demand for multiband functional antennas is rising at a faster pace as technical items become smaller. This research illustrates an E-shaped Microstrip Patch Antenna for multiband operations in the Ku band. Microstrip patch antennas have become more well-liked recently. In comparison to a conventional antenna, it provides a wider range of advantages, including a planar profile, the ability to operate in the microwave frequency range, cost-effective construction, and especially straightforward assembly using integrated circuit technology. Low-profile planar microstrip antennas can easily be made to conform to the host plane. They are easily mass manufactured because to their tiny volume, low weight, and inexpensive fabrication costs. The idea of a Micro-strip antenna was first put out by G. A. Deschamps in the 1950s. After printed circuit board (PCB) technology emerged in the 1970s, Howell and Munson developed the first functional Micro-strip antenna, opening up a large area of research all over the world [1]–[5].

A conducting patch of any nonplanar or planar form is present on one side of a dielectric substrate, and a ground plane is present on the other side. The ground plane gives the fringing fields enough reflections due to the variations in patch antenna length. There are many ways to feed Micro-strip patch antennas; the most popular ones include probe feed, Micro-strip line feed, proximity coupled feed, and aperture/slot-coupled feed. A cheap FR4 substrate with a 1.6mm thickness and a 4.2 dielectric constant was used to produce the design. The recommended technique and probe feeding strategy lead to the construction of an antenna that can operate in three different Ku band frequency bands. At 12.4 GHz, 13.28 GHz, and 14.45 GHz, respectively, the antenna exhibits directivity gains of 8.6, 9.5, and 7.4. This antenna's design and simulation were carried out using the IE3D application. This study [6]-[10] has looked at many antenna characteristic types.

In comparison to earlier research, the antenna design is improved, and it is simulated using ADS (Advanced Design System) software. A cheap FR4 substrate with a 1.6 mm thickness and a dielectric constant of 4.2 was used to develop the design. The proposed system is used in conjunction with the probe feeding method to operate within the 3.45 GHz frequency range. This study's main objective is to build an E-shaped microstrip antenna with adjustable size that can function in a range of environments. After comparing the parameter values of several antennas, the superior antenna will provide a notable improvement in return loss, bandwidth, gain, and directivity. For multiband operation in the Ku band area, this research provides a tiny E-shaped MPA. The proposed antenna may be used for stationary and transmitting satellites, earth exploration satellites, radio navigation for aircraft, space research, fixed mobile, fixed satellite (earth-to-space), and mobile satellite (earth-to-space) applications. When compared to RMPA, this article [11]-[16] states that trimming down two parallel slots (E shape) aids in multiband and improves antenna qualities.

E-SHAPED STRUCTURE

New artificial man-made Metamaterial may be used to improve antenna performance even more. It has recently attracted the attention of a number of RF engineers and researchers. Using HFSS software and information gathered from the calculation results, the design is then utilized to build an E-shaped microstrip antenna that is near to the fundamental design specifications. According to Fig. 1, this antenna rationing system uses a single probe feed to link the conductor patch to the ground plane via a hole in the ground plane and a shorting pin to attach the conductor patch to the ground plane. The ground-connected E-shaped patch antenna comes after the subtraction size. A FR4 Epoxy substrate with a relative dielectric constant of 4.2 and a thickness of 1.6 mm was used in this experiment. The connection uses a probe feed method to give matching impedance that is equal to the connector's impedance, which is 50 ohms. Figure 1 depicts the antenna's length (L), which is 6.577mm, and width (W), which is 9.296mm.

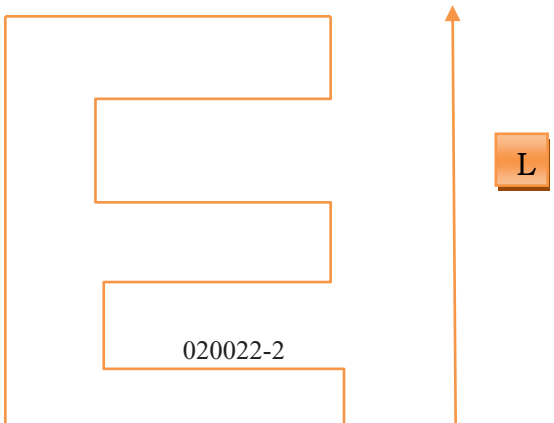


FIGURE 1. Proposed E-Shaped Structure

The previous poll focused on the design, significant concepts, and implementation issues and barriers. In the many recent surveys, which focused on different 5G technologies with different features, the authors did not cover all of the 5G network's technologies in-depth with issues and recent advances. A few authors looked at MIMO (Non-Orthogonal Multiple Access), NOMA, MEC, and micro cell technologies. On the other side, some concentrated on millimeter-wave technologies and beam forming (mmWave). However, from a research and development perspective, the prior study did not include all of the technologies used in the 5G network. There isn't a thorough analysis available that examines all 5G network technology and trade-offs in currently published research. As a consequence, our main objective is to provide an in-depth evaluation of all 5G technologies. On the other hand, this study contains both contemporary research methods and new, original developments made by academics. Several recent notable articles provide descriptions of the key technologies that are propelling the creation and production of 5G devices.

Sulfur is released and reacts with HC during the cycle's high-temperature phase.

The first step is to close the gap between the transmitter's and receiver's antennas. This explains why 5G networks are cellular networks that are tightly packed. A smaller cell size is required compared to current 4G technology since more antennas are required to cover a given area. The second factor to take into account is the installation of advanced beam shaping antennas. Friis' transmission formula's final iteration includes extra elements that denote antenna gain. The attractive way to increase gain is to use several antennas as opposed to only one. This is why antenna arrays, which are composed of several antennas, will be a part of future mobile communication systems.

With 5G technology, the transmitter base station may have hundreds of antennas installed. Massive multiple input, multiple output (MIMO) antennas will increase data rate and channel spectral efficiency. By using a variety of modulations, these huge MIMO antennas will allow wireless communication networks to simultaneously broadcast and receive several signals over the same radio channel. By creating radiation beams that are as thin as pencils, massive MIMO reduces inter-beam interference.

However, the radiation power level and duration were higher than what we are already seeing or may experience with the rollout of the 5G network. Since the biological structures of people and rats are not the same, as suggested by NTP, it cannot be connected to human health. Research is presently being done to determine how 5G network radiation affects both human and animal health.

But we need to find a solution by creating Green 5G technology, which lessens radiation's negative impacts on both humans and the environment. Massive MIMO is an energy-efficient antenna transmission technique that utilizes less power than current base stations, according to study. It thus releases less energy into the atmosphere. To provide optimal coverage, additional transmitter antennas will be required in the same area as the 5G network's cell sites increase in number. A significant amount of carbon would also be released into the environment during the production of a large number of network components for the 5G network to roll out services over the globe.

A dense configuration of cell sites would be used in a 5G network, possibly exacerbating the effect on bird eggs. Later, it may raise questions for the survival of birds. Additionally, a Spanish research found that breeding, nesting, and roosting are adversely impacted by RF radiation from mobile base stations.

Additionally, it has been proposed that the radiation from mobile signals has a detrimental effect on the capacity of bees to survive. In one investigation, colony collapse disorder was identified after 10 minutes of exposure to 900MHz radiation waves in beehives. Many bees in the hive left along with the queen and a few worker bees.

Radiation also affected bees' sense of direction, making it more difficult for them to find their own colony. Because they are essential to agriculture, bees are a crucial component of the earth's biosphere. More than half of the world's population gets the majority of their nourishment from agriculture.

The ecosystems of the planet are interconnected. The whole system will be affected if just one ecological module is disturbed. Dense cell locations and potential radiation increases are features of the 5G network.

Future generations will thus need to create green technologies in order to save our delicate ecology. It's also important to recognize several elements of 5G technology that guard against negative impacts. Environmental Impact Assessments must be performed at first by 5G network development. This research thoroughly examines the impact of the proposed technology on the environment before production and actual network implementation. This method minimises and finds harmful environmental consequences. Providing a secure and healthy environment for our future generations is crucial.

To further assess the impact that 5G will surely have on the environment, the approach of strategy Life Cycle Assessments is quite helpful. An LCA may be used to evaluate how a network affects carbon emissions throughout the course of its lifespan, including component manufacture, energy usage to run the device, and waste produced when the device is transferred to a disposal mechanism. It will be feasible to lessen the negative impacts on the ecosystem by thoroughly understanding the impact that new technologies will have on the environment.

Increased energy economy, network scope, throughput, decreased latency, and capacity are just a few advantages of this strategy. It may be implemented in three different ways: System Massive MIMO, Single Massive MIMO, and Distributed Massive MIMO. Based on the needs of the network, they are chosen based on their energy and power usage.

The figure below uses the maximum ratio transmission (MRT) and zero forcing (ZF) methodologies to explain massive MIMO systems. In this method, choosing the right antenna is crucial. The antennas used are energy-efficient to control the efficiency. An antenna muting approach may reduce energy consumption by up to 50%. All of the antenna's other ports are off when one port is switched on. Both the system's overall performance and the amount of energy saved will increase.

A few modern methods for expanding an antenna's bandwidth include changing the probe feed, utilizing numerous resonances, using folded patch feed, and using a slotted radiating element.

The E shape slot in the radiating element often has wideband characteristics. In order to counteract the inductive component of the probe, it's also feasible that an E-shaped slot adds a capacitive component to the input impedance. The substrate's thickness is also increased to make up for the rising inductive effect brought on by the slots.

As we are all aware, a layer's bandwidth increases as its thickness does. 52 percent input impedance is achievable. It seemed to be shaped like an inverted E due to the slots, and its bandwidth increased by 40%. In this design, an air-filled or foamed component was necessary to obtain broadband features.

RESULTS AND DISCUSSION

Resonance frequencies between 6GHz and 10GHz were discovered with sufficient bandwidths and gains. The suggested antenna has a maximum gain and directivity of 7.8 dB and 4.5 dBi, respectively. Characteristics including return loss, voltage standing wave ratio (VSWR), and gain were computed by simulations in the EM Field Solver programmer. The desired antenna form is constructed on a FR4 substrate with a permittivity of 4.2 and a thickness of 1.6 mm. Physical testing of the built-in antenna is done with the help of the VNA instrument. 7.8 decibels is the gain that is maximum. Figure 2 displays the return loss (S11) for the simulated shape. The simulation data shows five resonant peaks with return losses less than -10 dB. Figure 3 displays the VSWR plot for the simulated antenna setup. Figure 4 depicts the gain plot for the simulated antenna design. Figure 5 depicts the radiation pattern for the simulated antenna structure.

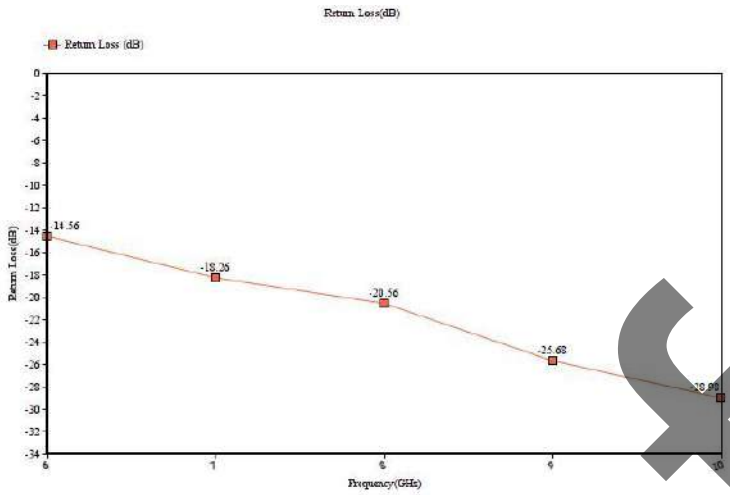


FIGURE 2. Return Loss of the Proposed Structure

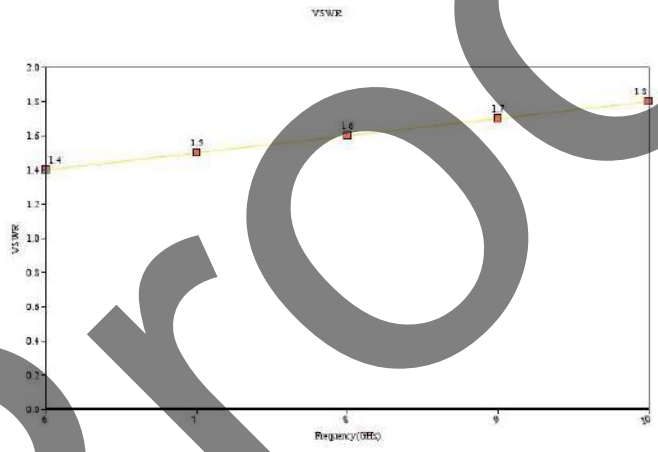


FIGURE 3. VSWR of the Proposed Structure

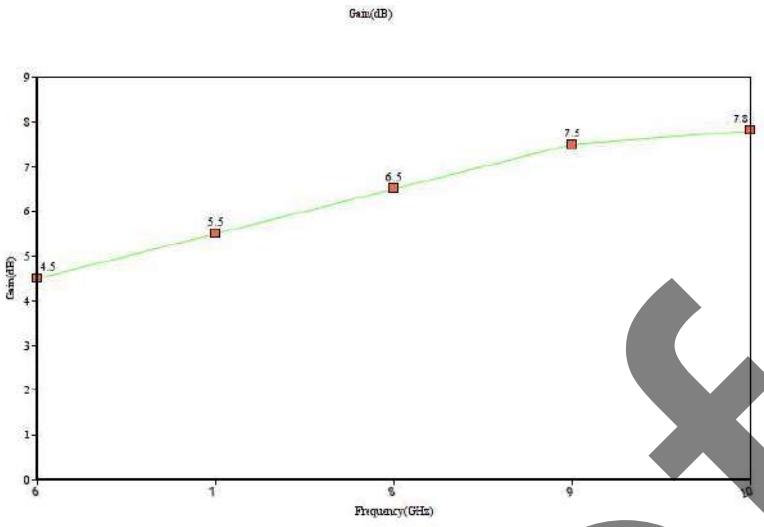
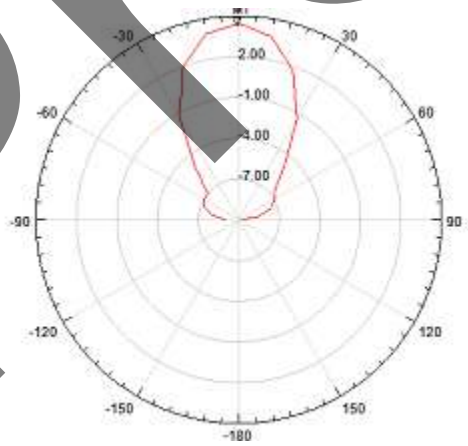


FIGURE 4. Gain of the Proposed Structure

The parameters for a simulation of a simple rectangular microstrip antenna were then adjusted for the best impedance matching using the data provided above. The antenna's gain is also increased by adding two parallel slots and tuning them such that the antenna almost resembles an E shape. Then, to as closely resemble an E shape as feasible, two more parallel slots and one perpendicular slot are created and optimized. The antenna is then made smaller and has a wider bandwidth by using a dielectric substrate with a dielectric constant. Finally, the necessary bandwidth, resonating frequency, and gain value are achieved via probe feeding. Five frequency bands, spanning from 6 GHz to 10 GHz, are available on the antenna. The calculated return loss values are -14.56 dB, 18.26 dB, 20.56 dB, -25.68 dB, and -28.98 dB for frequencies of 6, 7, 8, 9, and 10 GHz, respectively. Between 6GHz and 10GHz, where the resonant frequency peaks, the observed VSWR values are 1.4, 1.5, 1.6, 1.7, and 1.8, respectively. The gain is achieved at 4.5, 5.5, 6.5, 7.5, and 7.8dB to run the different frequencies between 6 GHz and 10 GHz.



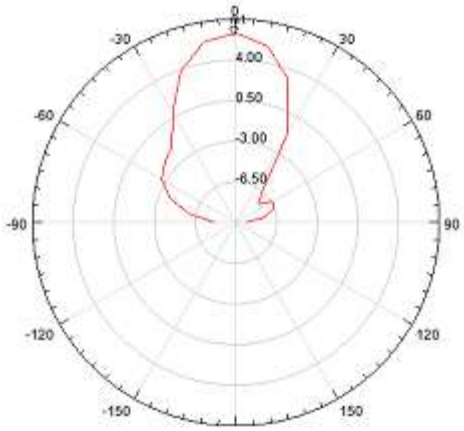


FIGURE 5. Radiation Pattern of the Proposed Structure

CONCLUSION

In this investigation, an E-shaped wideband microstrip patch antenna with an Air substrate was constructed, optimized, and examined. The results of a parametric research lead to the conclusion that the antenna can operate between 6 and 10 GHz. This result is an improvement over the previous standard, which saw the bandwidth boosted from 4.68 GHz to 5.4 GHz. Two other metrics that have been improved are S11 and VSWR. This review research first describes the role of massive MIMO technology in 5G technologies to enhance the spectral and energy efficiency of wireless channels. Both a 5G exposure scenario in an indoor environment and the effect of 5G network radiation on human health are examined. It is crucial to comprehend how cell towers impact birds and bees since all ecosystems on the world are interconnected. The whole ecology suffers when one component is compromised. Numerous factors, including carbon dioxide emissions, power consumption per site, green technology used, carbon footprint, RAN energy usage, and SAR values are compared for 3G, 4G, and 5G networks. As shown in the table, average power consumption per site decreases from 1.7 kW in 3G to 1.1 kW in 5G, despite an increase in carbon dioxide emissions from 86 metric tons in 3G to 235 metric tons in 5G. SAR is anticipated to decrease in contrast to 3G and 4G due to green technologies used in 5G, such as Device to Device transmission, massive MIMO, and spectrum sharing. Additionally, a number of human health issues are examined, including the effects on the skin, the eyes, the neurological system, and carcinogens. The plot of massive MIMO energy efficiency vs. spectral efficiency, which is shown last, shows that as the number of base station antennas increases, energy efficiency rises and network power usage falls. Future research using NOMA (Non-Orthogonal Multiple Access) technology offers some unique techniques to combat radiations and advances the possibility of further reducing radiation damage.

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Object Sovereign EEG Emotion Recognition

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Abstract. The most important challenge in analyzing brain data is how to successfully extract authentic and steady features from electroencephalography (EEG). Another issue is how to combine the spatial and temporal brain knowledge to get reliable feature depiction. Most contemporary EEG investigations are task-driven and use deep learning models to explore the valid EEG characteristics significantly constrained by the labels provided. This study proposes a new CNN-LSTM method which extracts temporal features with CNN and spatial features with LSTM. Differential entropy features from five frequency bands are extracted and fed as input to the model. The effectiveness of our CNN-LSTM extracted deep, low-dimensional features are rigorously assessed in an emotion identification utilization built on the foundation of SEED and SEEDIV emotion datasets. The outcomes show that the suggested model is solid and trustworthy, which is simple to learn and effective at fusing dynamic EEG information. Specifically, it has been proven to be the best for object sovereign emotion identification ability. We have an accuracy of97.62% for SEED and 93.06% for the SEEDIV dataset.

INTRODUCTION

Emotions influence human behaviour and play a significant part in everyday life. In general, many mental disorders, such as autism and depression, are associated with emotion [1, 2]. Thus, emotion is generally utilized as a reference for diagnosing psychic problems in individuals [3]. Human-computer interaction researchers are increasingly focusing on investigating EEG for distinct emotions elicited by certain stimulant specimens and evolving emotional artificial intelligence [4]. To engage the brain and reveal its coherent functions for emotion categorization [5], most research focuses on constructing experimental paradigms using multimedia content, such as pictures, sounds, and texts.

EEG signals may objectively represent various emotions and serve as a reliable method for identifying genuine emotions [6]. Positive emotions often exhibit high activation levels in the spatial-temporal dimension, whereas negative emotions exhibit the exact reverse. In the spatial-spectral dimension, a person is more likely to experience a negative feeling when the lower frequency band is more energized than, the higher frequency band. Positive emotion, on the other hand, operates oppositely. Significant discriminative local patterns are furthermore necessary for identifying various moods. For instance, the level of activity in β and γ bands of the temporal lobe regions is higher when the person is experiencing good emotion than negative emotion [6]. The above events drive researchers to classify distinct emotions based on EEG features using deep learning algorithms.

To interpret emotion, W. L. Zheng et al. [7] created a deep belief network (DBN) and discovered that the differential entropy (DE) [8] feature obtained from EEG data is an authenticate and substantialrecognition feature. YiminYang et al. [9] suggested a hierarchical network containing DE features from five frequency bands to analyze various moods. Deep learning algorithms have been utilised by some researchers to automatically gather dynamic information from unprocessed EEG data to determine temporal features. The raw EEG signals were mapped to the high-dimensional state space using recursive layer projections in the Echo State Network (ESN) developed by Fourati et al. [10]. Alhagry et al. [11] used a two-layered LSTM (Long Short Term Memory) using EEG signals as input to get successful findings. J. Ma et al. [12] proposed a multimodal residual LSTM model with shared temporal weights across several modalities to identify emotions. Based on 2D EEG maps for spatial feature eradication, Li et al. [13] built a hierarchical convolutional neural network to gather spatial information across many channels. Jung et al. [14] converted EEG data into image-based representations to better understand how different brain regions interact and discovered gratifying findings. A brand-new bi-hemispheric discrepancy model (BiHDM) was put out by Song et al. to detect EEG emotions [15]. A Graph Convolutional Broad Network (GCB-net) is created by Zhang et al. [16] to examine graph-structured data at a deeper level. Innovative dynamical graph convolutional neural networks were

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proposed by Song et al. [17]. A regularized graph neural network (RGNN) was presented by Zhong et al. [18] for EEG-based emotion categorization. The RGNN gathered local and global properties from EEG channels related to various brain locations. Deep Adaptation Network (DAN) was employed by Li et al. [19] to eliminate individual variations in EEG data. Last, Luo et al. [20] proposed the Wasserstein Generative Adversarial Network Domain Adaptation (UGANDA) framework for creating subject-independent emotion detection models. Bao et al. [21] created a Two-level Domain Adaptation Neural Network (TDANN) to establish a transfer model for EEG-based emotion categorization. Zhao et al. [6] employed a plug-and-play domain adaption technique to discover individual differences. However, studies attempting to use deep learning algorithms to identify object-sovereign emotions using EEG have not been effective.

First, the structure of multichannel EEG signals is based on the biological domain and belongs to a non-Euclidean domain. Therefore, the direct application of deep learning techniques to EEG-based Recognition is ineffective since these techniques are built for computer vision and NLP applications. Secondly, the EEG signals differ greatly across people, resulting in distinct dissemination of source and target. The anatomical and functional systems of the human brain exhibit characteristics of the biological domain. Although some current research is beginning to realize the importance of the topology of EEG channels, it does not leverage this structure to its fullest potential when learning salient EEG properties. When EEG training and testing data are collected from several people, most existing identification techniques perform poorly.

We offer a 1D convolution neural network [36] (1D CNN) combined with LSTM model to overcome the abovementioned challenges with object-sovereign emotion detection. The following part of the paper is organized: The datasets used in the demos and the background for the LSTM is discussed in Section II. The suggested approach is discussed in Section III. The test findings and performance evaluations are presented in section IV. In addition, the suggested strategy is compared to alternative approaches. Finally, we conclude in section V.

DATASET AND METHOD

In the first part we illustrate the datasets used in our demonstrations. In the second part we explain the basicCNN-LSTM model.

DATASET

We research the SEED [22] and SEED-IV [23] datasets to elicit emotion. Positive, negative, and neutral emotions are the three types found in the SEED dataset. Fifteen video clips representing three emotions are used in the data gathering procedure. Each clip is around 4 minutes long. The respondents can quickly recognize the movies, and they can all trigger a single desirable response. The video snippets are shown to 15 subjects. Each topic has three sets of tests, each with 15 video clips. Each clip-watching procedure has four stages: a five-second start of the session, a four-minute movie clip, a 45-second self-assessment, and a 15-second of the rest interval. The presentation is set up so that no two video snippets addressing the same emotion are presented consecutively. The volunteers are requested to provide rapid feedback after each trial, and the EEG signals of 62 channels are captured at a 1000 Hz sampling frequency. The raw EEG signals in the SEED dataset are down-sampled with 200 Hz.

In the SEED-IV dataset, there are four different emotions: fear, happiness, sadness, and neutral feelings. The study included 15 people. Each person will receive three studies, with 24 video snippets in each session. Each type of emotion is represented by six films, each lasting two minutes. Three phases make up each clip-watching procedure: a 5-second lead-in, a 2-minute movie clip, and a 45-second post-viewing self-evaluation. The ESI NeuroScan System records the subjects' 62-channel EEG data while asking them for feedback following each session. The EEG signals are divided into non-overlapping 4-second segments after being down-sampled at 128 Hz.

CNN-LSTM NETWORK

In this study, we have used the 1DCNN network. Convolutional Neural Network (CNN) layers are used in the CNN LSTM architecture to extract features from input data, and LSTMs are used to assist in sequence prediction. The convolution operation of the convolutional layer captures the spatial information from the input at nearby time points and produces feature maps [24]. The different spatial connection characteristics present in the surrounding input residual are extracted using the one-dimensional convolutional neural network. Since all of the units in the convolutional layer

have similar weights matrix connection [25], the parameters of CNN may be reduced, simplifying the training of the CNN model.

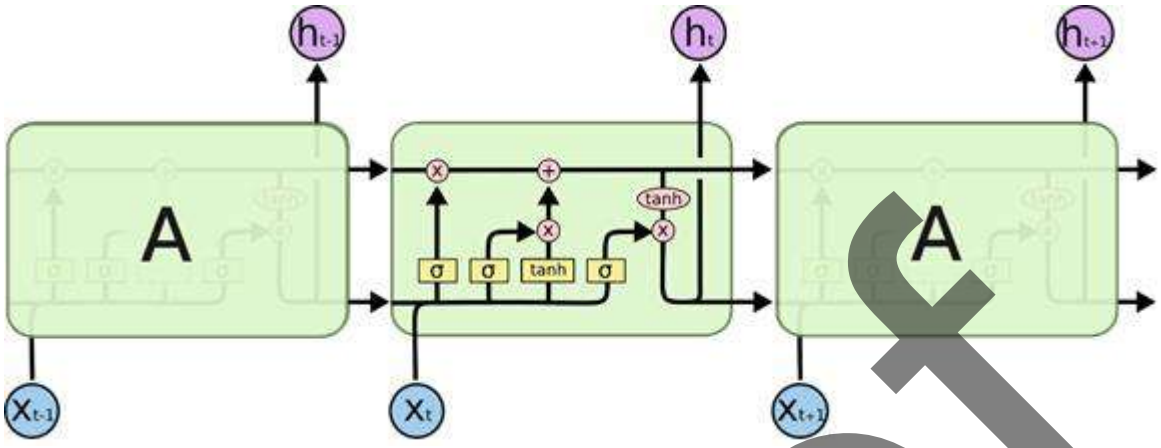


FIGURE 1: The LSTM architecture.

Figure 1 depicts the usual construction of an LSTM block [26]. The LSTM block has four gates: cell state gate f, for remembering information over time; forget gate ft, which regulates how much value is stored in the cell; input gate fi, which regulates how much value flows through the cell, and output gate fo, which regulates how much value in the cell must be used to compute the output. An ultimately linked layer and an activation function are both included in each gate. The LSTM block also has three inputs cell state Ct, previously concealed state ht, and current input xt and three outputs, cell state c, previously hidden state ht, and current output yt. The hidden state is used to create the current output. The following is a definition of the LSTM units' mathematical formulation:

$$ft = \sigma(w^{f}[x_t, h_{t-1}] \quad (1)$$

$$fi = \sigma(w^{i}[x_t, h_{t-1}] \quad (2)$$

$$f = \tanh(w[x_t, h_{t-1}] \quad (3)$$

$$fo = \sigma(w^{o}[x_t, h_{t-1}] \quad (4)$$

$$Ct = ft \times Ct - 1 + fi \times f \quad (5)$$

$$ht = fo \times \tanh(Ct) \quad (6)$$

$$yt = \sigma(w^{i}ht) \quad (7)$$

EEG data are processed using CNN and LSTM to extract regional and global characteristics. The convolution layer is capable of handling an X value grid. It can recognise a pattern of features, where each element results from many adjacent input components. Because LSTM is frequently trained to process a sequence of values X, each component of the learnt feature is a component of the prior output results. Combining CNN and LSTM enables the detection of distinguishing characteristics, including local and extended contextual relationships.

PROPOSED METHODOLGY

In this section we describe about differential entropy feature extraction method. We explain proposed model and its parameter selection.

FEATURE EXTRACTION

EEG signal feature creation is well suited for entropy analysis. It is primarily used to categorize EEG data. The fundamental idea behind entropy analysis is to take distinct entropies from standard frequency bands of EEG, and then utilize those entropies to build features that can most effectively distinguish between different signal types. Differential entropy is the most often utilized factor in EEG emotion categorization, according to prior research [8].Time series x conforms to the Gaussian distribution.Generally, the EEG signal's average energy value P may be used to reflect the signal's variation. The DE of EEG signals may be estimated by consideringa fixed time window of length N as

$$ht = \frac{1}{2}\log(p) + \frac{1}{2}\log(\frac{2\pi e}{N}) \quad (8)$$

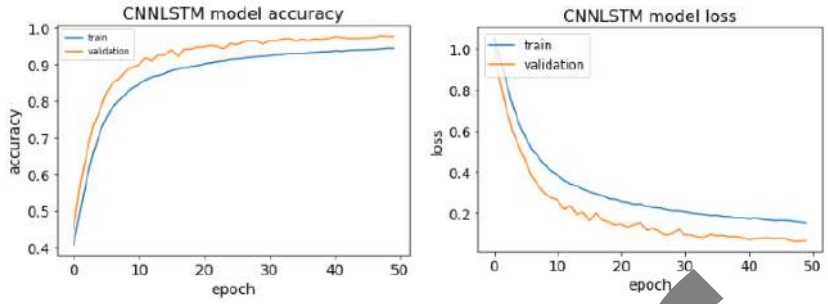
Raw EEG signal is filtered using a (0-75 Hz) bandpass filter. DE features are extracted against five frequency bands δ, θ, α, β, and γ bands with one second sliding window. These features are smoothened using linear discriminant system method to remove artefacts and noise from EEG signal. There are 152730 samples for SEED dataset and each sample has 62×5 i.e. 310 DE features.

PROPOSED CNN-LSTM NETWORK

The suggested CNN-LSTM [37] model consists of an input layer, two 1 D convolution modules, and two LSTM layers. The input format is 310 x1, which comprises 310 samples taken from each person's DE features. The convolution layer's kernel measures 3x1. Each convolutional layer will employ zero padding to prevent missing data from the input data. After the convolution procedure, the RELU activation function is employed. A max-pooling layer's pooling size is chosen 2x1 to minimize the data in the temporal dimension and increase the robustness of recovered features. LSTM layer with leaky RELU activation is used. A dropout layer follows each module to avoid over-fitting. A softmax activation is used for multiclass classification. To achieve remarkable performance, CNN-LSTM network hyper-parameters are selected on a trial and error basis. The training process is completed using the ADAM [27] optimizer and categorical cross-entropy cost function. The optimizer maintains a learning rate of 0.001. The network's dropout rate is set at 0.15 to avoid overfitting.

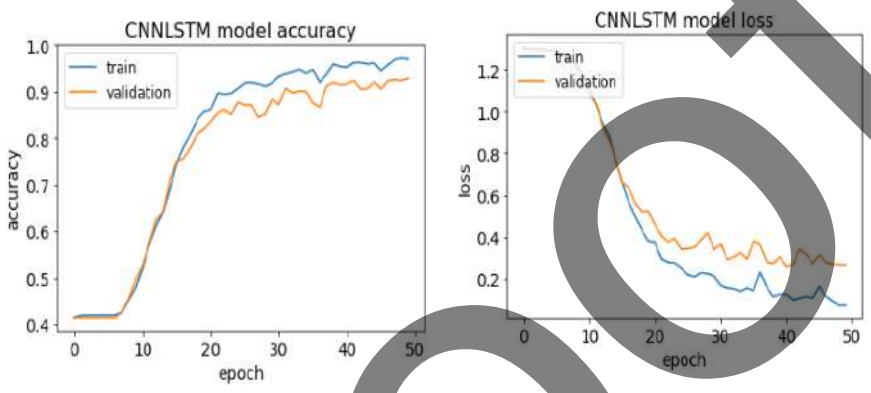
RESULT AND DISCUSSION

In this section, we first present the object sovereign results on SEED and SEED IV datasets. Then, we evaluated accuracy, confusion matrix and Cohen kappa value. For the experiment, we have taken nine subjects' data for training, three subject’s data for validation and three for testing. We have finally compared our results with other state-of-the-art methods. Tensor flow Keras is utilized to implement the proposed CNN-LSTM model. The Windows 2010 system, 8GB of RAM, Intel i5 CPU, and Tesla K40 GPU make up the hardware needed to implement the model. To evaluate the stability and utility of our model, we have adapted subject-independent emotion identification approaches. The majority of algorithms take into account valence and arousal, which are two stages of categorization. We assess the performance of CNN-LSTM on three and four-class classifications. In the subject-independent test, our CNN-LSTM model is trained using the SEED, and SEEDIV dataset's extracted DE features of all subject's three sessions combined. Table1 displays the findings of the performance evaluation of the two datasets.



(a) **(b)**

FIGURE 2. Training and validation curve for SEED dataset for (a) accuracy and (b) loss.



(a) (b)

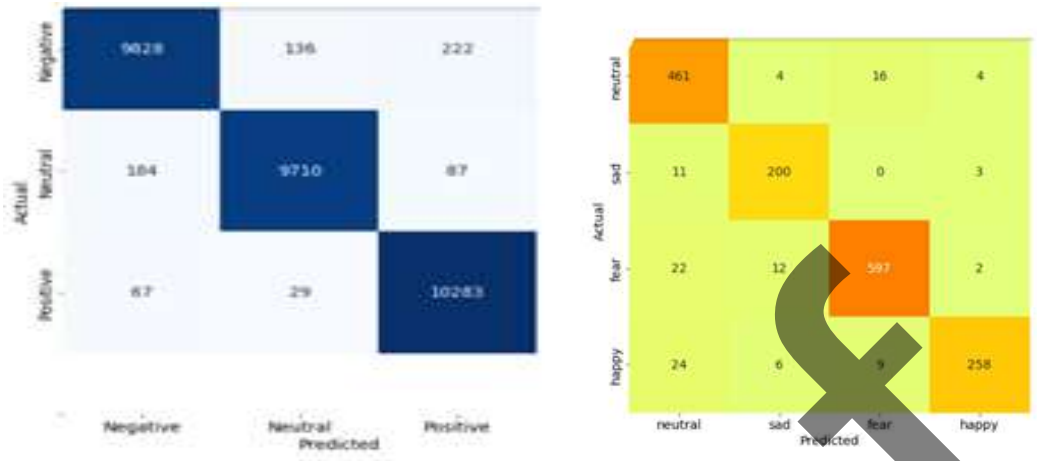
FIGURE 3. Training and validation curve for SEED IV dataset for (a) accuracy and (b) loss.

Figure 2 shows how well our model learns for a range of EEG parameters. As shown in figure 2(a), it can be seen that as the number of iterations rises, our network's recognition accuracy increases and become stable after certain iterations. For example, emotion categorization stabilized after 44 epochs for three classes with DE features. We have an accuracy [35] of 98% for negative and 97% for positive emotions with the proposed CNN-LSTM model. For the four-class categorization of the SEED IV dataset, the average accuracy with DE is 93.06% at about 50 epochs. Figure 3 represents the training and validation curve for the SEED IV dataset. Both the curves present that our model is properly fitted because the training and validation loss curves are decreasing to the point of stability, and validation loss has a short difference with training loss.

Figure 4 represents the confusion matrix for DE features which is further used to analyze the suggested model. It gives the number of accurate and inaccurate predictions with count values for each class. Table 1 describes the two dataset's precision, recall, and F1 scores for different emotions. The percentage of relevant occurrences among the recovered examples is known as precision. The percentage of the total number of relevant occurrences retrieved is known as recall or hit rate. The F1 score is a measurement of a test's accuracy. It is the harmonic mean of precision and hit rate. The maximum value of the F1 score is 1. It measures the preciseness and robustness of our model. When the value of the F1 score is more than 0.8 model is more accurate. The Cohen kappa value for the SEED dataset is 0.96, and SEEDIV is 0.90.

TABLE 1. Classification report for SEED dataset

Type of Emotion	Precision	Recall	F1 score
Negative	0.98	0.96	0.97
Neutral	0.98	0.97	0.98
Positive	0.97	0.99	0.98



(a) (b)

FIGURE 4. Confusion matrix for (a) SEED and (b) SEED IV dataset

TABLE 2. Classification report for SEED IV dataset

Type of Emotion	Precision	Recall	F1 score
Neutral	0.89	0.95	0.92
Sad	0.90	0.93	0.92
Fear	0.96	0.94	0.95
Happy	0.97	0.87	0.91

The effectiveness of a proposed model is assessed using the coefficient of determination, often known as the R2 score. Depending on the ratio of total deviation of outcomes the model gives, it is used to assess how effectively observed results are replicated. The R2 score for SEED is 0.94, and SEEDIV is 0.85. We have compared our model against eleven other approaches, including SVM [28], TCA [29], A-LSTM [30], DBN [6], DAN [19], Deep SRU [31], DGCNN [17], BiDANN [32], BiHDM [15], CNN-LSTM with adaptive regularization [33] and CNN [34], in order to verify that our CNN-LSTM is superior to them all. To make a clear comparison with our technique, we used the data from past research to compare all the abovementioned methodologies. Table 3 provides a summary of the findings.

TABLE 3. Comparison of proposed CNN-LSTM method with other deep learning methods

Method	Features	Accuracy/STD for SEED (%)	Accuracy/STD for SEEDIV (%)
Support Vector Machine[28]	DE	56.7/16.3	38/12.5
Transfer Component Analysis [29]	DE	63.65/14.87	56.6/13.78
Attention-LSTM [30]	Hilebert-Huang spectrum	80.2/10.84	77.28/13.9
Deep Belief Network [6]	DE	86.07/8.34	66.78/10.02
Deep Adaptation Network [19]	DE	83.80/8.57	58.88/8.14
Deep Simple Recurrent Unit [31]	Dual tree Complex wavelet	79.62/7.04	64.32/9.11
Dynamic Graph CNN [17]	DE	79.951/9.02	52.53/09.24
Bi-hemispheres Domain Adversarial NN [32]	DE	83.29/9.61	65.6/10.40
Bi-hemispheric Discrepancy Model [15]	DE	85.4/7.53	69.04/8.67
CNN-LSTM with adaptive Regularization [33]	CNN features + two frequency bands	78.11/6.11	-
CNN [34]	DE 2D feature map	-	72.8/05.78
Proposed CNN-LSTM	DE	97.62/6.55	93.06/4.6

Our suggested CNN-LSTM model outperforms every other approach on the SEED and SEED IV datasets, according to the data in Table 3. BiHDAM has concentrated on constructing a model that aids in learning the discrepancy connection between two hemispheres to improve the accuracy. Unlabeled testing data were used by the DANN and BiDANN algorithms to enhance performance. The graphical representation of DGCNN has found intrinsic relationships among different EEG channels. In [33], the authors used two CNN with different filters to extract temporal and frequency features and merged them with DE. They have applied adaptive regularization to obtain spatial information with BiLSTM to improve accuracy. CNN [34] has drawn a 2D feature map from DE features. To fairly compare our results with different approaches, we solely considered labelled training data in our experiment.

CONCLUSION

A unique technique for emotion identification has been developed by integrating the CNN and LSTM networks. Our network consisted of three layers of 1D CNN and two layers of LSTM. As can be seen, merging these networks enhances the recommended method's precision and stability. For the subject-independent study on the SEED dataset, we found an accuracy of 97.62%, and for SEED IV, 93.06%, respectively. These results are promising when compared to earlier emotion detection methods. However, this technique still has certain problems despite its improvements, just like other modules. First, we chose the parameters for the training method and learning rate by trial and error. Therefore, it would be better to establish a systematized procedure for selecting the proper parameters. Second, we require a GPU processor to train the dataset as the dataset size is big, and deep learning approaches significantly rely on powerful computers. In future, we are planning to implement the same model for a reduced number of channels and estimate results.

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A Novel Vehicle Tracking Approach using Random Forest Classifier for Disaster Management System along with R-CNN for Enhancing the Performance

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Abstract. The Internet of Things (IoT) smart devices makes a significant contribution to the development of smart cities, which are becoming increasingly technologically advanced over time. Find out how many artificial intelligence-based monitoring systems have the potential to save people's lives in a variety of different scenarios. Better organisation of disaster management is required in order to reduce loss of life and maintain an accurate accounting of property damage. It is possible to quickly send assistance to those who are in need, including fire extinguishers, ambulances, and other emergency vehicles. These days, it is also possible to use visual equipment in order to evaluate a scenario and find actions that can be repeated. This was not the case in the past. Using the systems that are currently available, it is possible to track the location of an ambulance. GPS and surveillance cameras can be utilised in order to precisely pinpoint the location. In the work that is being proposed, a new intervention method is used to extract features for the purpose of object detection and vehicle tracking. Image object detection and the angle of view covering the entire NH road are utilised in this process (AoV). R-CNN, which stands for Region-based convolutional neural network, is an algorithm that can be helpful when carrying out research. In a time of crisis, it offers the ideal combination of different visual cues to assist you in finding your way. When analysing traffic during times of heavy congestion, both the position of the camera and the way in which drivers and passengers interact with one another on the road are taken into consideration. Targeting automobiles is possible based on the zone in which they operate and the associated time variations. The Random Forest algorithm and the Adam optimizer, both of which are based on neural networks, are interpreted in order to determine how accurately classifiers perform their tasks. These adjustments were made in order to improve the overall performance of the system while maintaining the same level of effectiveness with the monitoring services rotating through 360 degrees.

INTRODUCTION

The study of disaster management is a relatively new field of research that has attracted researchers from a diverse range of fields, including computer science and environmental studies, amongst others. Mostly Disasters that are caused by humans, such as fires and earthquakes, and natural disasters, such as floods and hurricanes, can be separated into two categories when discussing emergency situations that involve the use of dangerous materials or terrorist acts. For instance, the importance of warnings and early detection cannot be overstated [1]. This is in addition to the importance of preventing natural disasters and making preparations for them. Additionally, it is essential to provide medical care for those who have been injured [2]. The four stages that make up disaster management are called

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preparation, mitigation, response, and recovery. They all make use of a variety of different types of information. Some of the technologies that are utilised to process data include extracting and retrieving information, filtering information, and providing support for decision-making [2–3]. It is possible to identify a disaster and get a head start on the process of recovery by utilising data from a variety of sources.

Online data streaming from CCTV cameras has made it much simpler to identify potentially catastrophic events, such as fires and floods, at an earlier stage [4, 5]. It is easier for emergency management teams to assist those who are in need of assistance when they are able to recover from the effects of a disaster more quickly and save more lives. In order to avoid problems in the future, they must first be identified as quickly as possible. This is an essential part of emergency management and preparedness. The location of the vehicles can be determined in a number of different ways, including through the application of warning systems or systems that are sensor-based. The outdated approaches have a number of inherent flaws, one of which is the inability to update the precise location of missing data regarding the size of it. The utilisation of sensors in later methods attracted a significant number of researchers due to the fact that they were more cost-effective, could monitor larger areas, and could react more quickly than other methods [6–9]. The sensor-based methods, on the other hand, have a number of drawbacks, including poor image quality, inadequate signal transmission, and a lack of contrast in the photographs they take [7–9]. The issues with CNN (Convolutional Neural Networks) that were discussed earlier have been a challenge when it comes to the development of systems for disaster management [10, 11].

It is essential for the management of highway traffic to be able to locate vehicles and derive statistics from video footage [12]. By utilising cameras that have been installed solely for the purpose of monitoring traffic [13], it is possible to keep an eye on what is going on at all times. When conducting object detection, it is essential to keep an eye on the flow of traffic and to strictly enforce the laws [14]. The roads are getting increasingly congested, and the pace of traffic is picking up. When there are traffic jams and people are parking on the road, the risk of getting into an accident is significantly increased. The installation of surveillance cameras is being done in order to locate and examine the vehicles that are currently on the road. When sensors or other image-processing methods are used, there is a possibility of causing damage to roads [16]. It is essential to make full use of the resources available for monitoring and employing deep CNN methods if one is interested in successfully locating objects within video frames.

At the same time, it is possible to track down and locate vehicles. In the past, one method that was utilised for locating something was to use moving targets. As a direct consequence of this, the task of determining the nature of the object has been successfully accomplished. In the past, techniques such as background subtraction and frame difference methods, such as optical flow, have been utilised for vehicle detection. It is possible to detect vehicles in order to compile information regarding the flow of traffic, such as the number of vehicles and the speed at which they travel. CNN is no longer having issues with finding and following objects, which is a huge relief for the news organisation.

The objectives of the proposed works is as follows,

1. To utilize the novel intervention method that can extract the features which are in movement and track the vehicle to reach the destination in an accurate time.
2. R-CNN, an efficient deep learning algorithm proposed for detecting the exact location in an emergency situation to track the vehicle's current direction.
3. Calculating the performance accuracy based on image parameters and initiating the localization on the vehicle movement, classifying the object in accordance with all 360 degrees.

The paper is organized as the following sections, Section 2 discusses the existing works available in literature, Section 3 explains the proposed system, Section 4 discusses the results obtained from the proposed work and Section 5 concludes the paper.

RELATED WORKS

OBJECT DETECTION

Object detection is another possible application for machine vision and deep learning. The old methods relied on the movement of the vehicle as a means of distinguishing it from the background image, which remained static throughout the process [17]. The method described above can be broken down into three distinct subtypes: an optical flow, a background image, and continuous video frames. The second approach entails performing an addition on the pixel values and video frame values that are seen to follow one another in time. Setting a threshold value allows you to differentiate the foreground from the background of an image. If you use this method and then turn down the noise,

you will be able to tell when a car has stopped moving. The video always has the same image serving as the background. These data may be utilised in the process of developing a model for this circumstance [18].

It is possible to distinguish the moving object from the background model by comparing the images of each frame to the model of the background. A video captured by a third party can be analysed to pinpoint the locations of any moving objects [19]. A corresponding field will show both the speed and the direction of motion for each individual pixel. SIFT and SURF are methods that stand for Scale Invariant Feature Transforms and Scale Invariant Feature Transform, respectively. One of the most common ways to find vehicles is to look at their features using either of these two methods. In addition, 3D models can be utilised to locate and group works. In order to accomplish this task, correlation curves are utilised, which take into consideration the exterior of the vehicle.

Using a model known as CNN, which stands for "Convolutional Neural Network," it is also possible to find cars. A picture can be memorised, and there are a number of activities that are associated with this, such as categorising pictures. When looking for something, there are two stages involved in the process [20]. To begin, an algorithm is used to generate a list of possible boxes for the object that is being given. After that, CNN is used to categorise the object. If there is only one stage used to find something, then candidates will not be generated. We are now faced with the challenge of dealing with a regression problem as opposed to an optimization problem. A region convolutional neural network, also referred to as an R-CNN, is utilised in yet another approach to the process of searching an image. The size of the image that is uploaded to CNN ought to be decided in advance. The more complex the structure is, the more time and effort is required for training, and the more memory is required.

SPPNET functions very well due to the fact that input images can be of varying sizes while output images are consistent in size. Because of things like R-FCN and FPN, amongst others [21], it is now possible to extract features in a much simpler manner. Things can be categorised in a variety of different ways, and the available options for characteristics have grown. There are two one-step frameworks known as "Single Shot Multibox Detector" (also abbreviated as "SSD") and "You Only Look Once" (also abbreviated as "YOLO"). Methods known as Multibox and RPN (RegionProposal Network) are utilised in SSD in order to set the anchor boxes and position the objects in the appropriate location. Images are simplified and made easier to read thanks to the YOLO framework's use of grids. The grids each have an important part to play in the process of predicting where the objects will be, and the grids contain the objects' centre points.

A new layer in YOLOv2 called Batch Normalization is responsible for standardising the input for all of the other layers in YOLOv2. Bringing the process of network convergence to a faster pace. In this method, random selection is used to select new images to use for multiscale training for each set of ten images. Another model identified vehicles that were utilising YOLOv3 [22]. This approach to classifying information utilises a process known as logical regression. Additionally, it can help with problems involving a combination of different labels. We are able to use logical regression to figure out whether or not the IOU value is greater than 0.5 when we are regressing the level of confidence in the box. When this particular condition is satisfied, only then will the largest possible pior box be taken into account. YOLOv3 uses a number of different scales that are based on the number three when it is attempting to figure out what kind of thing something is.

When the brightness of the images changes, methods of machine vision that are faster don't always provide accurate results. Additionally, factors that have an impact on the results include background motion and vehicles moving at a slow pace. CNN's capability of adjusting its sensitivity to shifts in scale has made it much simpler to locate objects in a scene. A one-scale grid method is used to make a prediction about an object [23]. On the other hand, the grids that are used in two-scale methods have a restricted amount of space, which prevents them from achieving a significantly higher degree of precision. In order to accomplish this, we make use of the acronym ROI, which stands for "Region of Interest." This allows us to divide candidate regions into blocks.

The amount of padding is determined by the size of the candidate region and is determined using the parameter size that has been specified. This causes damage to the structure of the small object, which makes it more difficult to identify the object. At the moment, it is difficult to differentiate between objects in the artwork that are small and those that are large. In addition to this, when they are used for detection, they produce false positives. Image pyramids are a useful tool for accomplishing this, but the processing time required is prohibitive.

OBJECT TRACKING

Detection-based tracking, also known as DBT, and detection-free tracking, also known as DFT, are two methods that can be used to initiate the tracking of multiple objects [24]. The background modelling stage of the DBT method is where the detection of moving objects in video frames takes place. This step comes before the tracking stage. Because this DFT method is unable to handle new objects being added or old objects being removed, the first step in the tracking process is to initialise the objects. The algorithms that are used to detect multiple objects take into account

both the objects that are in and outside of the frame. The NCC can be used to normalise the degree of inter-frame entity similarity (Normalized Cross-Correlation).

When determining the distance between two objects based on their colour histograms, the Bhattacharya distance is what is used. When objects are associated with inter-frame entities, they will show up in a single track; however, this will only happen if there is only one track available. Exclusion, either at the detection or the trajectory levels, is going to be necessary in order to find a solution to this issue. SIFT features such as scale and illumination changes are important considerations to make when dealing with moving objects [26]. [27]. However, when compared to the other possible detection methods, this one has a relatively low sensitivity. When compared to the SIFT method, the ORB features of another detection method allow for the extraction of features to occur at a significantly faster rate. Research on vehicle detection is moving away from more conventional methods and toward more contemporary approaches such as convolutional neural networks. In addition, there is a dearth of traffic data that can be accessed. CNN states that it can be challenging to make an accurate identification of objects that are of a small size. Keeping track of a large number of objects and analysing the flow of traffic using surveillance footage from highway cameras are the two aspects of the job that present the greatest challenges.

DATASET

The angle of view, also referred to as AoV, is an essential component of the dataset that can be retrieved with the help of the surveillance camera that has been installed on each and every NHroad. In this specific instance, the search for the vehicle was carried out with the assistance of an R-CNN algorithm, which was effective in reducing the impact of the catastrophic event. During the course of their trip, numerous vehicles of various types are arranged in a number of different configurations. These vehicles include proclainers, ambulances, and fire engines, amongst others.

Support for all 360 degrees of visual detection and monitoring of roadways can be provided by a set of guidelines for monitoring roadways that include speed and distance (AoI), camera direction (AoI), GPS accuracy, time, and lateral angle (AoA). These are positioned at an angle of ninety degrees with respect to the longitudinal axis of the road, and they are utilised in the process of determining the control point distances that exist between the various locations of each segmentation.

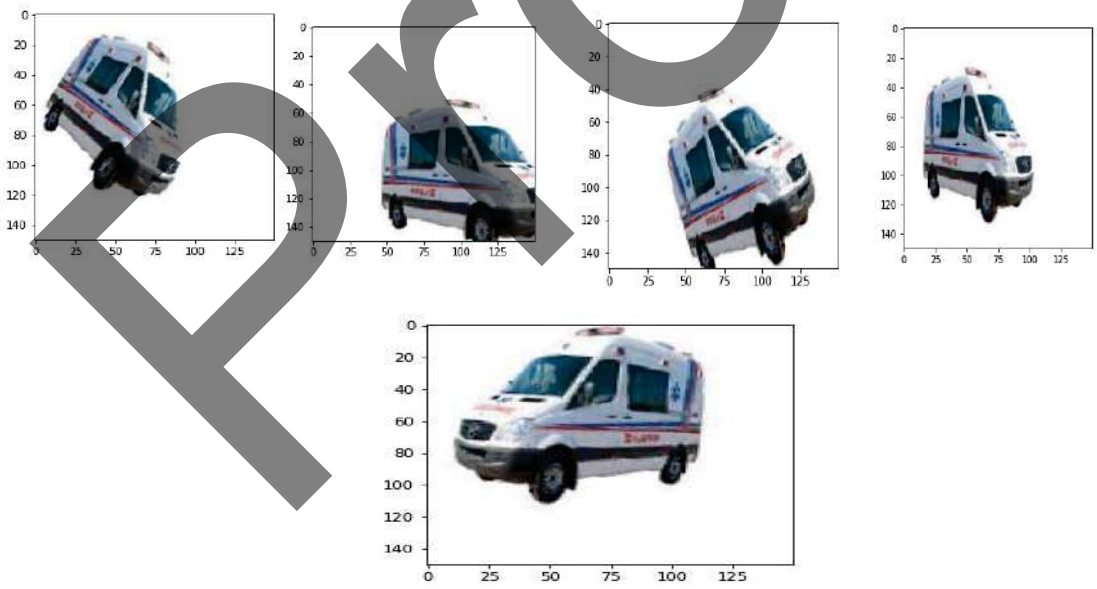

FIGURE.1 Angle of View (AoI) of vehicle at lateral & longitudinal angle

The method that has been suggested makes use of a dataset that has more than 54,890 pictures of different kinds of emergency support vehicles. In the event of a natural disaster, anyone tasked with rescuing batchers faces an uphill battle regardless of how severe the weather changes become. Utilizing artificial intelligence is a huge help when it comes to the task of monitoring all of the vehicles on the road as well as natural disasters. This is achieved by employing robotic intervention and receiving updates in a timeframe that is very close to instantaneous. For instance,

the angle of view (AoV) of each detected vehicle is shown in Figure.1. This figure provides an overall 360-degree view of controlling trajectories and GPS updates, both of which have the potential to lower death rates. By utilising geo-references from surveillance cameras, such as latitude and longitudinal updates, nearby hospitals and supporters are able to swiftly set up beds, necessary items, elderly care needs, and medications, among other things, to respond to the situation as it develops. The required detected position can be converted into an alert about the emergency level, which makes tracking vehicles and developing frame-by-frame updates possible.

FEATURE EXTRACTION AND MONITRING OF VECHICELS BY CLASSIFICATION AND LOCALIZATION

When employing R-CNNs for class and label prediction while making use of a boundary box for a region on an R-CNN, the ratio of probability should be greater than 0.5. We use a CNN framework that is based on Imagenet and a batch size of 64 so that the dataset that we created for the vehicle tracking system can be preprocessed. When the batch size has the maximum number of round regions that can represent the ceiling, the initialised search algorithm for localization is generated, and classes are finally formed. When the prediction falls anywhere between N and Rn, it is possible to validate the prediction using only the I value and the batch size (Number of rounds). This is the highest possible class that must be greater than in order to map the extracted features from vehicle movement (0.5).

The primary benefits of using CNNs based on ImageNet's architecture to set up the convolution layer include the addition of a neural network as well as the model that was developed for vehicle tracking on New Hampshire roads during emergency situations. In order to train the image classification, it is possible to use images from other disaster areas with the name "RegVehicle." Additionally, the limited 2000 boundary region can be used in order to localise the working feature. The random forest algorithm is able to construct a framework for carrying out classification and regression on segmented images by making use of the image that is currently at hand as a starting point. Both the location of emergency vehicles and the display of label classes and their pixel can be accomplished through the utilisation of multiply-created regions. With the dataset and the testing model, the neural network that is based on the ImageNet framework can be compared for reliable output from the movement vehicle. This ensures that the right direction and the exact time to assist the suffering people in protection can be successfully complied with.

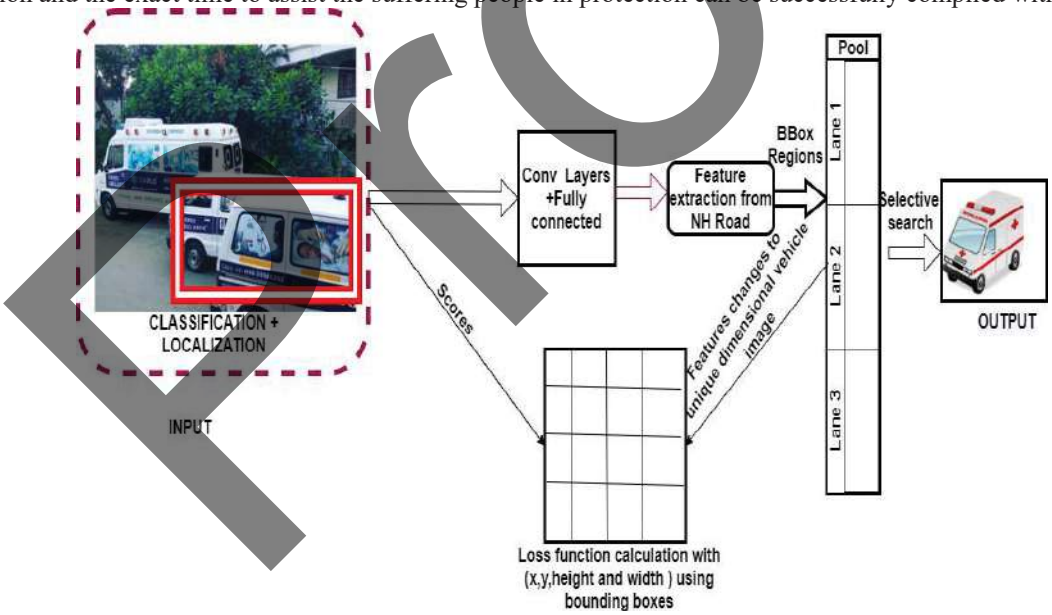

FIGURE.2 Classification and localization of vehicle tracking from BBoxRegions

When employing R-CNNs for class and label prediction while making use of a boundary box for a region on an R-CNN, the ratio of probability should be greater than 0.5. We use a CNN framework that is based on Imagenet and a batch size of 64 so that the dataset that we created for the vehicle tracking system can be preprocessed. When the batch size has the maximum number of round regions that can represent the ceiling, the initialised search algorithm for localization is generated, and classes are finally formed. When the prediction falls anywhere between N and Rn, it is possible to validate the prediction using only the I value and the batch size (Number of rounds). This is the highest possible class that must be greater than in order to map the extracted features from vehicle movement (0.5).

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COMPARISON OF EXISTING SYSTEM SVM VS RANDOM FOREST CLASSIFIER

Object classifiers are utilised in the decision-making process of feature-based detection. For instance, when dealing with problems involving multiple regions, a neural network that is based on supervised learning is utilised. This network possesses a collection of decisions for classifying the current region, which includes powerful and less powerful classifiers. After a successful identification, a single extracted region is chosen from a pool of 2000 regions to provide a description of the parameters that currently apply to the working image. When the instance matches become mismatched or when the limit of 2000 images is exceeded, SVM fails in both classification and regression. This can happen either when the limit of images is exceeded. It is possible for there to be an increase in complexity if boundary boxes are not correctly fed into well-trained datasets. SVM is not a good choice when making decisions in this situation; however, random forests are a better choice because they show the decision line through a BBbox region that can find the smoother position to increase scalability. Consequently, random forests are the better choice.

PROPOSED SYSTEM

An interesting method to identify or mark the specific object for object detection in images is to use a boundary box that covers the marked location or features from the entire image that was represented as an input. This box should cover the image in its entirety. The main limitations of simple convolutional neural networks are built in this way. These networks have a fully connected layer and can retrieve the feature to classify from an image for detection. The use of a single boundary causes the detection of the involvement object to be unsuccessful. This is due to the fact that the spatial input positions within the images that are provided and the mapping ratio used to map the involvement object are completely different from one another.

These limitations can be conquered if multiple boundaries are added to the Region of Interest (RoI) that is defined in the input dataset. For the purpose of selecting regions, the unfixed area of the NH road is utilised to determine the precise location of regions that have been fetched from the entire image in accordance with the recommendations made by RoI. Utilizing the Selective ROI Searching Technique (SRST), which restricts the area of vehicle movement to the NH road alone, is one way to cut down on the number of steps needed to determine the location of a target area.

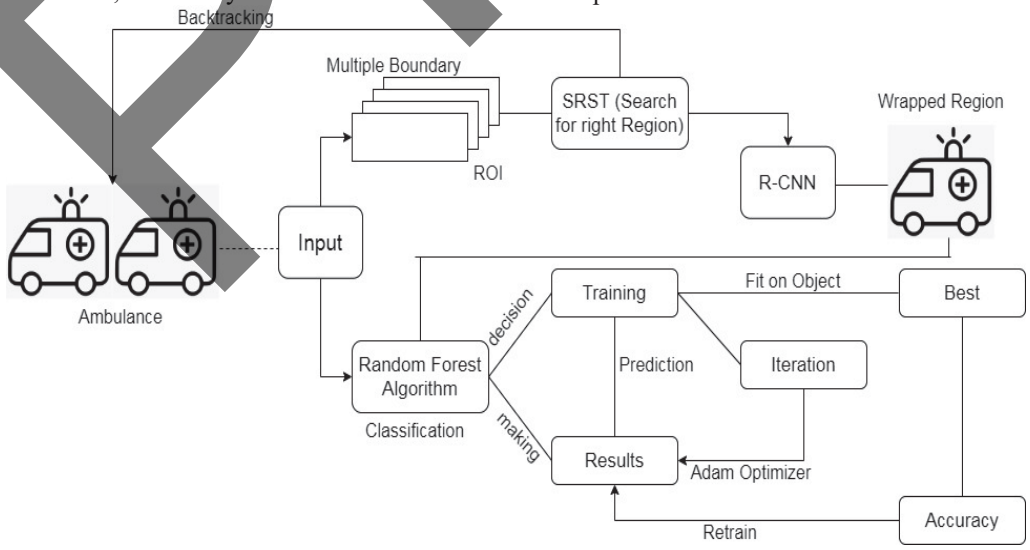

FIGURE.3 Proposed diagram for vehicle tracking approach using R-CNN

ALGORITHM FOR SRST

a) Start the basic segmentation (S)(class independent object)
b) Initialize the sub-segmentation (Ss)
c) Start multiple working regions
d) Use backtracking(b) procedure
e) Keep going to find similar working region comparatively larger regions
f) Set up the initialized region to fetch the last working region as proposed results to classify the image.
g) Stop the SRST to set the new right region.

On the NH route (R-CNN), which has a large number of movements and objects that can be used to verify the vehicle's identity and track its performance, convolutional neural networks (CNNs) will be utilised to detect vehicles. When it comes to detecting vehicles along the NH route, this method is more reliable than the systems that are currently in place. Figure.3 depicts the training and testing analysis of the dataset by assigning multiple regions that predict the matching features from the input that is used for localization. This is done in order to concentrate on the number of iterations required to locate the correct vehicle. In order to keep track of the search algorithm (SRST) and map the image features that can pair within the wrapped area, the regions of interest (RoI) are aligned from the multiple boundary rectangular box. A different method can be used to obtain the subsequent set of regions from the surveillance camera in the cardinalities that are missing. By going back and re-examining the features that were randomly selected, it is possible to get accurate results quickly and in an efficient manner.

In order to provide stable support in the disaster management system through the introduction of a variety of workflow stages, vehicle detection methods are required. These methods are used to track the location of emergency vehicles such as ambulances and fire engines.

5 PHASES OF R- CNN

Phase (1) - Fixing the vehicle(object) for region selection.
Phase (2) - Apply the SRST algorithm for initializing the sub-segmentation of the vehicle image that can be the expected feature(object).
Phase (3) - Choose the shape,type of vehicles, color and size for similarity boundaries from the region.
Phase (4) - Apply the proposed algorithm to generate the boundary boxes on each input images
Phase (5) - Classifying the image by removing the redundant pixel from the boundaries and working on the trained images uniquely.

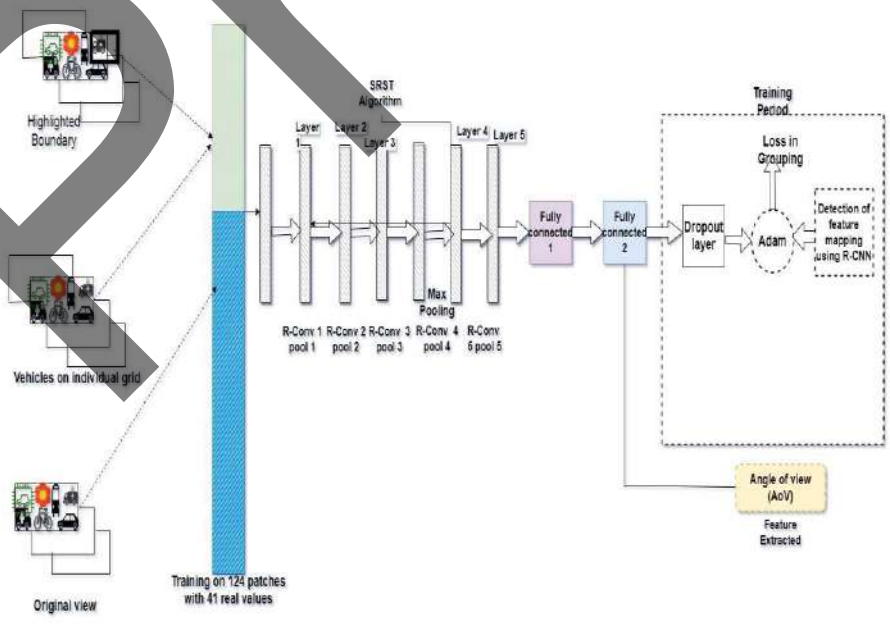

FIGURE 4. Feature Extraction using R - CNN approach on original image

One of the most effective ways to remain current with the most recent advancements in the field is to optimise the weights and biases of neural networks. A rescaling of the original image is necessary for accurate computing because it enables an adjustment of the diagonal value from the actual matrix value based on factors such as positive input. This adjustment is necessary for accurate computing because the original image must be rescaled. Figure 4 illustrates this information, which can be used to determine the accuracy and loss functions. Adam optimizers can be used to remove noisy parameters from finalBBbox features. This makes it possible to apply the fine-tuning parameters for tracking in the correct direction and accurately initiating it.

VECHICLE DETECTION WITH LOCALIZATION AND CLASSIFICATION USING REGION BASED CONVOLUTIONAL NEURAL NETWORK (R-CNN) SENSOR AND ITS VISUAL SUPPORT IN TRACKING SYSTEM

The dataset was created through the use of real-time capture of moving vehicles so that the detection process that comes from motion images could be understood better. The random forest algorithm is used to handle the efficiency of the results in classification and feature analysis when the R-CNN fixes the boundary regions.

Feature prediction is an essential part of both the Random forest algorithm and the SRST algorithm. Both of these algorithms are based on the tree and its nodes, and neither of them creates search based on data splitting. Instead, decisions are proposed based on the threshold, which alerts the previous way in which nodes behave so that object detection can be taken into account during the processing stage of the analysis. The performance analysis that is provided by detection is superior to that which is provided by existing frameworks like RNN. Detection is based on the distance between each input in the image.

The figure demonstrates how multiple images from the input can be connected together to form a single, unified layer.

Utilizing convolutional neural networks allows for two distinct methods of level generation for boundary conditions (CNNs). If visual images obtained through neural network views assist in weight and bias sharing in accordance with the input, then the process of feature mapping has the potential to generate a hidden network prevention.

During disaster management the main aim of fire services,police and Ambulances is to identify the people from the disaster moment and are responsible for their safety.In recent days it is possible to find the disaster based on scientific approaches or even technical measurements are used to find the level of impact through disasters. For example in 2021 one of the major disaster was the Uttarakhand flood which has brought the situation completely down by affecting all the regions over the districts. During the situation the vehicles that supported were helipads for relief operations and much more was planned for electric cars that can support through sensors. In general disaster management, the visual support from on road such as tracking the vehicles using GPS trackers etcare also supportive systems.

RESULTS AND DISCUSSION

Jupyter notebook is used to implement the results of vehicle tracking and detection systems. This allows for much faster searching of the matching boundary region and feeding the location using GPS derived from the input image. The proposed regions are filtered from convolution to the RoI pooling layer as a mapping ratio in order to reduce noise and wrap the modified original image of the selected vehicle input. This is done so that the proposed regions can be used. Even though CNN is reshaping it on a mapping feature basis, we still generate a candidate region that is capable of applying the dropout layer as well as the updated fixed size from the previous conv layer. Because of this, the boundary layer displays the boundary region along with its offset values and the timing of the RoI that is backtracked from the original image.

FIGURE 5. Reshaping and Image classification

The session time for practising data contains a total of 4096 features. These features include sessions to implement more than one boundary and sessions to locate an exact BBbox boundary line by utilising the SRT algorithm. In order to ensure that the neural layer is not impacted by unmapped regions, significant amounts of cross-checking are performed in between the training and testing phases of the process. If lateral views are included in the network of movement, mapped feature regions can be categorised and localised using offset values derived from the bounding difference of a vehicle. When the frames shown in figure 5 are used, the threshold values can be changed to cover a wider or narrower range of class and label options, respectively, depending on which setting the user chooses to use. Using GPS and sensors that provide real-time 360-degree views, it is possible to get a visual representation of the disaster area's likelihood of being affected by the event.

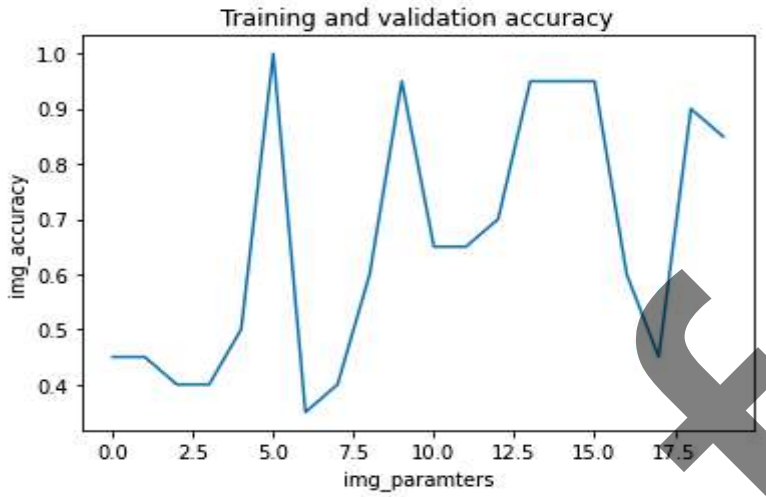

FIGURE.6 Prediction Accuracy (%) variation during Training and Validation

Adam classifier based on emergency enabled Ambulances with the four classes such as

A1 - Ambulance, A2 - Fire Engines

A3 - Proclainer, A4 - Image background

To reduce over fitting during computation the dataset with the four classified labels are trained with the multiple region using boundary rectangular boxes such that the drop out can maintain the simulation of each regularization that are changed during the vehicle movement and avoid the over fitting in the proposed deep learning model.When the vehicle forms the classes that are localized and shared the output in the pipeline is classified, the features used for regularization are rx,ry,rh,rwwhich bounds the located vehicle. The region covered for coordinate points are

top left of vehicle(object) - (0,0) & initial right - (1,1)

midpoint of boundary BBbox - rx,ry - length and breadth of boundary box - rh,rw

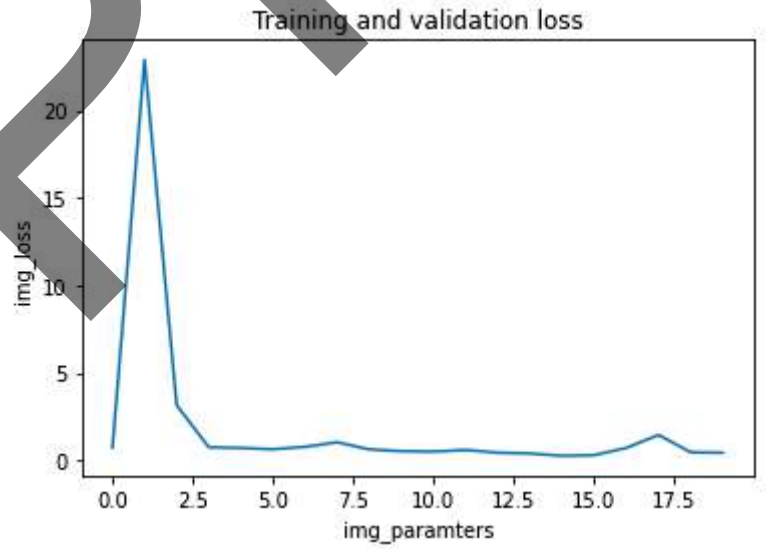

FIGURE.7 Validation loss (%) using R-CNN

Let us consider the individual image where only the single boundary box are considered, in such situation R-CNN can fix using the labeled vehicles to set the representation of each type of vehicle and training process(as shown in figure.6) can coordinate the images to set the exact mapping. Only the coordinate midpoints identify the mismatched pair from A1,A2,A3 and A4. If the image fails to show any of the type of detection,then no emergency vehicles pass by on NH road. The loss values for the training dataset with the localization using R-CNN results negative. The loss function general definition in deep learning and neural networks is stated in Equation (1)

$$\int(a^{\wedge},a)=(a^{\wedge}1-a1)2+(a^{\wedge}2-a2)2+...+(a^{\wedge}8-a8)2 \qquad \textbf{Equation (1)}$$

Where 'a' defines the objects that are to be classified and localized using Convolutional neural network techniques.

In the proposed model when the vehicle detection fails then the image features a loss function where there is no match for the selected object for prediction. Using the keras packages in the implementation dense layer are identified with Tensorflow packages for predicting the features with the error bars. These errors are computed as loss functions with the Mean Squared Error(MSE) and cross entropy error that also fails in weight balancing among the input images.The target features are unbalanced based on type, color or any other features in expected actual values. This variation is shown in figure.7 to understand the loss function in comparison with the accuracy results. Using the loss function the training based on the input can be increased or decreased to identify the exact mapping.

CONCLUSION AND FUTURE WORK

The field of artificial intelligence (AI) is concentrating its efforts by cooperating with one another in an intricate field such as computer vision. In all automated applications eager for essential operations that can boost computer vision production productivity, YOLO, R-CNN, and other cutting-edge concepts are the best ways to predict object detection. These methods are also among the most effective ways to detect other cutting-edge concepts. Using the proposed system, one might be able to detect, for instance, a system designed to track vehicles. In the event of an emergency, the surveillance camera of a disaster management system is watched from every conceivable vantage point. It is possible to detect the entire lateral and longitudinal range on NH Road because it is such a busy road and vehicles are always moving along it. R-CNN is utilised in the work that is proposed in order to locate the exact region by searching for the exact object. This is accomplished by classifying and localising a boundary region in a manner that is compatible with the predicted features of the data. Masking the current features and the hidden neural networks that classify and localise the generation of proposed regions, which can be tested and validated in a fraction of a second, will be implemented in the future for video motion and movable tracking systems in order to produce an accuracy level in a manner that is both faster and more precise.

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An Improved Analysis of Cryptocurrencies for Business Trading Deterministic with Deep Learning Techniques

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Abstract. As the number of people infected with COVID-19 continued to rise, many nations placed their entire nations under a complete lockdown. As a direct consequence of this, the entire world is currently experiencing a catastrophic financial crisis. As a result of the pandemic, unemployment rates have increased across a number of different sectors, which is having a significant negative effect on international trade. During this challenging period, Artificial Intelligence (AI) is altering the way businesses examine the statistics pertaining to their cryptocurrency holdings. Utilizing artificial intelligence (AI) in the realm of business can result in a variety of positive outcomes. The technological effects of AI make our day-to-day lives simpler because they eliminate the need for human intervention in many situations. It would be helpful to have a better understanding of artificial intelligence and the methods it uses, such as the classifier model, in the event that there was a pandemic. If people have access to real-time data analysis and predictions that have been generated by AI and big data, they will be able to make better decisions. In anticipation of the arrival of a new world, the company, along with SMEs and start-ups, is stepping up its efforts to enhance the management of virtual businesses by establishing a presence on multiple e-trade systems. Artificial intelligence (AI) has emerged as a key player in the quest to find effective solutions to issues that arise in the workplace. AI is being applied to improve business operations in many different areas, including marketing, fraud detection, algorithmic trading, customer service, portfolio management, and product recommendations based on what customers want. These are just some of the many problems that are being solved by AI. In addition, technological advancements could be made in order to enhance the functionality of the suggested guidelines and achieve the most precise result possible in light of the current value of cryptocurrencies.

INTRODUCTION

There has been a widespread outbreak of COVID-19 all over the world. People who cough, sneeze, or engage in other forms of breathing while in close proximity to an ill person can spread viruses through the air. At the moment, there is no treatment available for this illness. Taking the medication as directed is the most effective way to protect yourself from becoming ill. The COVID-19 outbreak has been classified as a public health emergency by the World Health Organization (WHO) [1] due to the fact that it has spread across the entire world. The proliferation of the disease has had a significant negative effect on the expansion of the global economy. The economic situation has suffered more damage as a result of the lockdown at the power plant than the lives of the people who were trapped inside. Since the nation has been under a state of emergency for such a long time, the economy is in a state of crisis, with unemployment on the rise and a lack of workers due to the high rate of fatalities. During this challenging period, AI in particular is making a significant contribution to improving the situation. This method is helpful in terms of prediction, diagnosis, and treatment all on their own. Because of its ability to impersonate a human, it can enter areas that regular people are not permitted to go. Artificial intelligence (AI) models can play a role in the economic recovery process by facilitating the production of skilled labourers and the automation of machines. The COVID-19 outbreak

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has had an effect on virtually all of the most significant corporations in the world. In the year 2020, business and trade have been affected by the deadly virus. This encompasses the entire process, from the manufacturing to the marketing of the product. During the COVID-19 flu epidemic, all sectors of the economy felt a significant impact, but this was especially true in operationally large industries, where the crisis accelerated the adoption of digital technology and increased digitalization.

To put it another way, a company can be defined as a group of people and assets whose primary goal is to make a profit through the performance of activities that are either commercial, professional, or business-related. Since businesses are such an important part of the economy, you should give some thought to starting your own. When it comes to beginning a business, there are no rules that must be adhered to regarding the size of the company that must be started. A company can be owned by a single person or by more than one person working together. [2] Many different types of companies have benefited from modern technology, but the larger ones have reaped the greatest rewards from it. There is a race to the top in terms of technological prowess being waged by major corporations such as Google, Facebook, and Amazon, amongst others.

In the contemporary world, the era is continually shifting, and this has a significant impact on all areas [3, 4]. Because of it, there have been developments made in numerous fields, including medicine, business, and many others [4]. In this brave new world, many companies are embracing cutting-edge technology in the hope that it will help them increase their profits and speed up their expansion. The introduction of artificial intelligence (AI), data science, big data, and the internet of things has fundamentally changed the way businesses operate as well as the behaviour of their employees in the workplace (IoT). Artificial intelligence, also known as AI, has been implemented across the board in every industry [5]. Both the business and the time sectors are good places to look for opportunities to study AI and other forms of computing technology. Machines are capable of performing certain tasks more effectively than humans, including the recognition of emotions, the making of snap decisions, and the automation of tasks. [6] This has been common knowledge for quite some time. In the next ten years, it is possible that the computer age will replace humans in the workforce in an astounding 47 percent of all jobs across the globe [7]. There is no question that technological advancement has had a significant influence on the economy, and there is also no question that this trend will continue in the years to come. Therefore, it is essential to ensure that you are current with the most recent trends in business technology. AI has been successfully incorporated into professions that require higher-order thinking and creative problem-solving, such as those of journalists, lawyers, laboratory technicians, and paralegals. The use of computer technology, artificial intelligence (AI), and other computational methods are particularly well-suited to certain types of administrative work, for instance. There has been a rise in the number of people looking for jobs that require high levels of professional expertise, as well as jobs that require the construction of specific kinds of computer systems. An intriguing finding was discovered by Soni et al. [8] in their research on one hundred new artificial intelligence companies located all over the world. In 2011, these one hundred businesses were awarded a combined total of $25.88 million in grants from them. They gave a total of $1866,600,000,000 in 2016. Within just a few short years, these organisations have seen a staggering 7112.5 percent increase in the amount of funding they receive. At this very moment, the realm of business is being revolutionised by the application of artificial

The outline of this paper is as follows. Section 2 discusses the type of cryptocurrency. Section 3 explain the various related work. Section 4 depicts the proposed methodology of this work. Section 4 show the performance analysis for conventional and proposed methodology. Finally, Section 5 conclude this work.

CRYPTOCURRENCY

In 2008, Bitcoin was transformed into a peer-to-peer (P2P) price coins machine. Bitcoin was an unregulated virtual currency that did not have a criminal connotation. A cryptographic aspect of the technology combined with the decentralised manner in which funds are transferred defines it as a cryptocurrency. Bitcoin has established itself as the most well-known currency for volume trading in recent years, and as a result, it has become the most promising economic medium for investors [9]. Sender, receiver, and the total amount of the transaction are all encoded to ensure the safety of the transaction [10].

Ethereum (XRP), which is based on blockchain technology, is a decentralised platform that can be used to build and run distributed systems as well as smart contracts [11, 12]. Ether is the name that has been given to the value of the currency. One year after the company was established in 2013, its founder, Vitalik Buterin, was able to fund the project thanks to a public crowd sale on the internet that brought in a total of US$18 million. Ether is free to move around and can be traded on exchanges just like any other cryptocurrency because there are no restrictions placed on its movement. It is no longer planned to implement a fee system; rather, it will be used within a private Ethereum network when it is eventually implemented.

Charles Lee devised Litecoin (LTC), which was introduced to the public in October 2011 and uses a generation process that is analogous to that of Bitcoin. The maximum restriction has been raised to 84 million, which is four times the amount of Bitcoin [14]. The block era time has been cut in half (from 10 minutes to 2. 5 minutes according to block), and the maximum restriction was raised to 84 million. The cryptocurrency known as Litecoin is considered to be the industry standard, and it is currently the second most popular cryptocurrency among miners and exchanges. It is possible to hasten the process of transaction confirmation on the Bitcoin network by substituting the Scrypt encryption rule set for the SHA-256 algorithm. In addition to this, there is a predetermined set of guidelines that is unaffected by any developments in the underlying hardware.

Customers of the NEM blockchain notarization platform are able to send and receive money with one another as well as trade their existing currency for NEM tokens. NEM is the most popular public/personal blockchain combination due to the fact that its notarization is owned by the community as a whole. It is important to keep in mind that the Ripple price medium is entirely controlled and maintained by a single company [10], which is something to keep in mind when discussing the Ripple price medium. Jed McCaleb and Chris Larsen came up with the idea for it in 2012 and developed it into an open supply virtual currency. Because of this, an increased level of safety is ensured. Ripple, a cryptocurrency with a maximum range of one hundred million, was developed with the help of this protocol.

It is a comprehensive security tool that is constructed on a Byzantine Consensus Protocol similar to Ripple. Stellar's newly installed device boasts a number of desirable characteristics, including open source software, dispersed ownership, and infinite ownership.

RELATED WORK

The analysis of sentiment and information, algorithmic trading, portfolio management, marketing, economic product advice systems, and commercial advice are some examples of the many areas of finance and business that make use of artificial intelligence and large amounts of data. Other examples include loan underwriting, the detection of fraud, customer service, and the provision of information. In the following sections, which cover a wide range of topics, we will talk about some AI methods and the applications of those methods.

The act of buying and selling goods and services are two of the most fundamental ideas in both economics and business. You can think of buying and selling financial entities such as stocks or currencies as a form of shopping and promoting. Some examples of financial entities include stocks and currencies. People and businesses engage in the purchasing and selling of various goods and services in order to generate monetary gain. There are four components that go into the buying and selling process, and they are the pre-change evaluation, the creation of buying and selling signs, the implementation of the change, and the post-change evaluation [15]. The automation of any or all of these processes, as well as any combination of those processes, is what is meant when people talk about "algorithmic buying and selling." The buying and selling process in this industry has been completely revolutionised by the application of AI automation. It is possible for multiple buying and selling algorithms driven by AI to generate revenue without the involvement of a human being in the process.

One of the most critical problems facing the global economy at the moment is fraud. Every year, businesses lose billions of dollars due to fraudulent activity. The total amount of money lost due to fraud in 2018 was estimated to be $27.85 billion by several sources, and it is anticipated that this number will increase to $40.63 billion over the course of the next decade [16]. This total is higher than the GDP of a number of nations that are exhibiting positive economic growth. Therefore, it is essential to have computer systems that are capable of detecting and preventing fraud, as this could have a significant impact not only on the expansion of the company but also on its finances. Researchers have found that they are able to construct complex systems by making use of structures that involve both artificial intelligence and system learning. A detection of irregularities as well as abuse The terms "anomaly" and "misuse" can be used to classify detection as a type of technique for the prevention of fraudulent activity [17]. In the case of anomaly detection, the transaction history of a consumer is looked at in order to determine whether or not a new transaction carried out by that consumer is typical or out of the ordinary. The model makes use of a tagged data set that contains information on each customer, and it determines fraudulent behaviour primarily by analysing prevalent fraudulent trends.

The authors of [18] propose a method for accurately predicting the price of stocks by making use of an approach that is based on learning. They are able to access the New York Inventory Trade Dataset as a direct consequence of this fact. Utilizing the LSTM neural network is done here (Long Short Term Memory). LSTMs operate in the same manner as memory molecules in the same way that conventional synthetic neural networks do. It's possible that these memory cells could also act as a link between memories stored in the entry records structure and the close records

structure, which would result in an original prediction. The LSTM system that they trained with consisted of dense layers, linearly spaced temporal memory (LSTM) layers, and a linear activation characteristic output layer. According to the findings of this research carried out by Roondiwala et al., the best-performing LSTM had a Root Mean Square Error (RMSE) of just 0.00859, which is a measure of how accurately artificial intelligence can be used to predict the values of inventory (which is very low).

Additionally, customer service has been made more efficient by the implementation of technologies such as artificial intelligence and statistical analysis [19]. Because of advances in AI technology, businesses no longer have to hire customer service representatives with exceptional levels of expertise. It is possible to make a chatbot accessible all day, every day of the week, and at all hours, so that it can provide answers to a wide range of questions posed by customers. Using a large expertise database from which it has learned, artificial intelligence (AI) is able to manage customer inquiries. This results in a significant reduction in the employment costs incurred by a company, and the same work can be accomplished for a fraction of the cost, which enables the company to flourish.

The field of marketing has also been influenced by artificial intelligence (AI) and massive amounts of data. Data-driven marketing is a lot more effective than human-centered marketing, which is why data-driven marketing is becoming increasingly popular. YouTube has become an increasingly important part of modern culture. For instance, in order to provide targeted and individualised advertisements, Facebook, in addition to other social media websites such as Instagram and Snapchat, makes use of artificial intelligence and device learning technology. Commercials relating to guitars are more likely to be seen by people who are interested in guitars when broadcast on these networks. Artificial intelligence (AI) has almost certainly had the most significant impact in the business world on the field of marketing [20].

TABLE 1. Summary of survey on data analysis of business trading using Cryptocurrency

Authors	Methods used	Cases used
Gupta et al. [21]	ANN with PSO	Phishing detection in cyber security
Kim et al. [22]	LSTM	Intrusion detection in cyber security
Cui et al. [23]	NPL+Deep ANN	Customer service
Colianni et al.[24]	NPL+SVM/NB	Bitcoin price prediction
Roondiwala et al. [25]	LSTM	Stock prices prediction
Randhawa et al. [26]	ANN+NB	Fraud detection
Auan et al. [27]	Random Forest	Fraud detection
Awoyemi et al [28]	KNN/NB	Fraud detection
Paradarami et al. [29]	Deep ANN	Product Recommendation

The previous research is summarised in Table 1, with a particular emphasis placed on more recent endeavours. According to the findings of the survey, artificial intelligence can contribute to the expansion of businesses in a variety of ways, including the identification of fraudulent activity and the provision of product recommendations. Business analytics is utilised by traders in the stock market and in the bitcoin market to construct models that forecast the future.

PROPOSED METHODOLOGY

It is possible for the datasets that are readily available from the source to have an effect on the time collection records that are used as input for the models that are being investigated in this study. The daily open, closing, high, and occasional fees are generated from the market capitalization database between the years 2013 and 2018, and this information is obtained from the daily trading records of six distinct types of cryptocurrencies.

Understanding and being skilled in the art of evaluation is essential to the success of any buyer or seller. Evaluations of both the essential and technical aspects are used in the process of determining future value. Statistics from outside the market, such as monetary conditions, interest rates, and geopolitical events are used in other strategies [30], while statistics from the market itself, such as price and volume of sales, are used in the technical evaluation of a company's future direction. While the majority of purchasers are more concerned with the product's technical aspects, others are more interested in the product's more fundamental aspects. This is a common concern among purchasers, even though some people are curious about the overlaps that exist between essential evaluation and technical

evaluation. In order to accomplish the goal of providing technical data analysis, this project will make use of various machine learning techniques. Machine learning has been taken seriously as a model in classical statistics for the purpose of forecasting for more than two decades [31, 32].

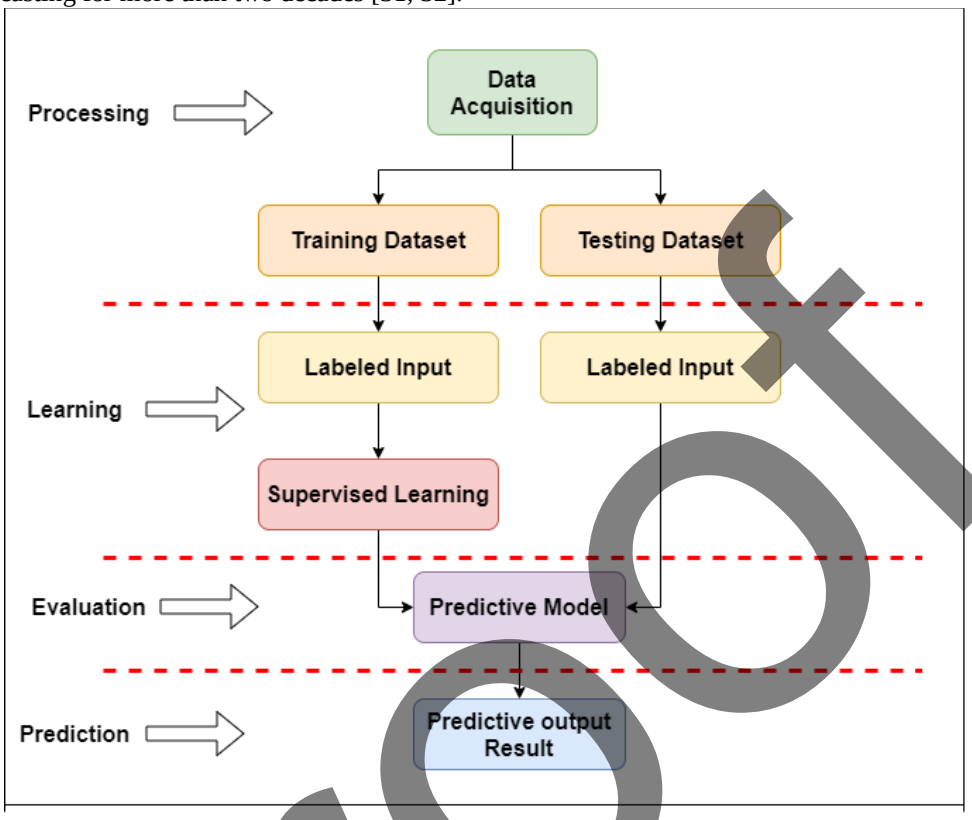

FIGURE 1. Proposed Methodology

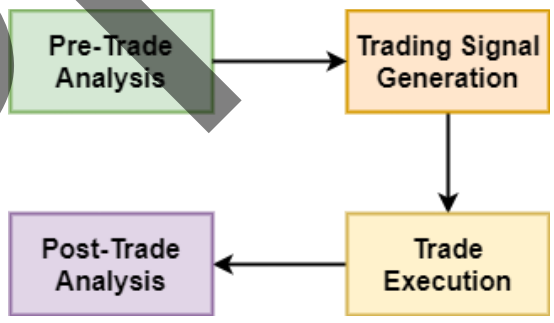

FIGURE 2. Steps in a complete algorithmic trading system

ARTIFICIAL INTELLIGENCE METHODS–USEFUL IN THE BUSINESS AND ECONOMIC SECTORS

To get more value out of Business Analytics, use advanced Artificial Intelligence approaches.

- Create strong prediction and classification models using neural networks, genetic algorithms, support vector machines, and fuzzy systems, among other methods.
- Improve fraud detection, cross-selling, credit score analysis, and profiling.
- New case studies and examples from around the company are included.

Artificial intelligence can help people get more value out of business analytics, account for uncertainty and complexity more effectively, and make smarter decisions. This book delves into today's most important artificial intelligence principles, tools, knowledge, and tactics, as well as how to put them to use in the real world.

Pseudo	
Variable	**Description**
Open Price	The first price of a given cryptocurrency in a daily trading
Close Price	The price of the last transaction for a given cryptocurrency at the end of a daily trading
High Price	The highest price that was paid for a cryptocurrency during a daily trading
Low Price	The lowest price of a cryptocurrency reached in a daily trading

RESULTS AND DISCUSSION

The performance measurements based on classifiers for each type of cryptocurrency are listed first in the results section. Using these helps keep the rest of the discussion on course. There are two primary tests in this investigation: I Machine learning algorithms predicted that Bitcoin would be worth more than it actually was, but the actual value of the currency was much less than what they predicted. On the basis of cryptocurrency market capitalisation, the performance of four classifiers is depicted in Figure 3. Our time series data training and testing datasets are shown in Figure 3.

TABLE 2. Cryptocurrecies with different testing and training data

Cryptocurrecies	**Training Data**	**Testing Data**
	Observation	**Observation**
Bitcoin	1388	364
Ethereum	526	364
Litecoin	1358	364
Nem	657	364
Ripple	1262	364
Stellar	896	364

TABLE 3. Performance Measures by various classifiers

Performance Accuracy (%)						
Classifiers	Bitcoin	Ethereum	Litecoin	Nem	Ripple	Stellar
SVM [30]	68.90	96.50	83.40	46.60	71.00	57.70
ANN [31]	80.50	79.00	76.80	78.80	82.40	88.80
DL [32]	62.90	68.40	63.80	58.20	61.90	71.70
Proposed Classifier	82.20	82.60	73.20	78.40	82.50	93.90

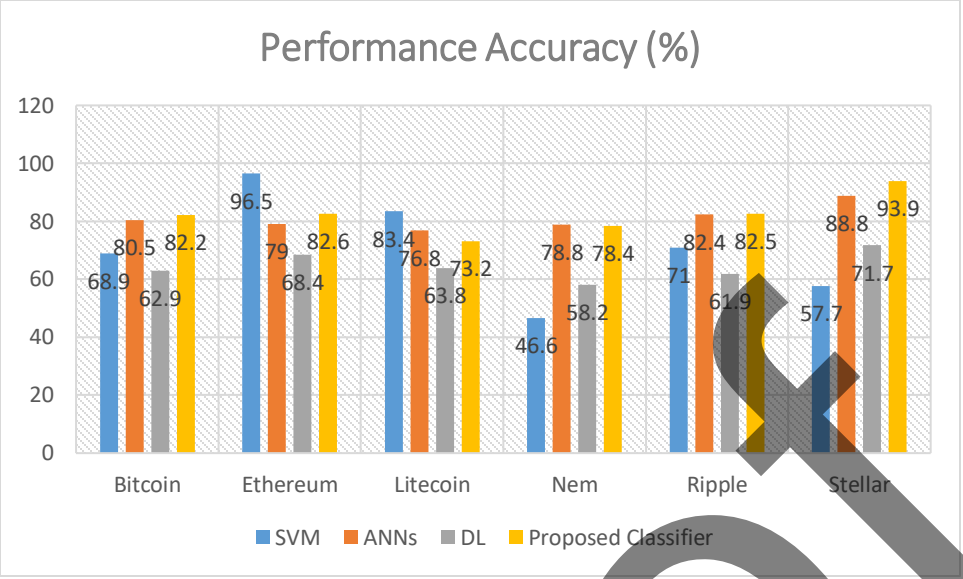

FIGURE 3. Comparison performance of accuracy for conventional with proposed methodology

CONCLUSION

Constraints placed on human activity have had a significant influence on the state of the economy of the entire world as a direct result of the failure of several commercial enterprises. The epidemic has had a negative impact on a large number of different industries across the world as well as in the United States. As a result of this, the demand-supply dynamic is no longer functioning as it should. AI-based ideas and strategies are being used by a wide range of businesses, from the very largest to the very smallest. The development of AI and Big Data has made it possible to conduct data analysis in real time, during which it is possible to identify, track, and make predictions. As a result of the digitalization of commerce, companies are now able to deliver their products and services directly to the doorsteps of their customers. However, despite appearances to the contrary, artificial intelligence's contribution to the business and commerce sectors is severely constrained. Machine Learning examined the difference between the actual value of bitcoin and the predicted value of cryptocurrencies. The findings indicated that the true worth of a bitcoin was significantly higher. Calculating the mean absolute percentage error, or MAPE, is another step in the analysis process that follows after the findings have been gathered.

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Recent Management Trends involved with the Internet of Things in Indian Automotive Components Manufacturing Industries

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Abstract. The development of smart manufacturing systems is being driven by a variety of diverse needs for the dependability of equipment and the prediction of quality. In order to accomplish this objective through the use of machine learning, a wide range of approaches are being investigated. The management and protection of one's company's data presents yet another challenging aspect of doing business. In order to cope with fraudulent datasets, machine learning and internet of things technologies were utilised. These technologies were used to protect system transactions and manage a dataset. Because of this, we were able to find solutions to the problems that we had previously discussed. The gathered information was organised and examined with the help of big data techniques. The Internet of Things system was constructed using the Hyperledger Fabric platform, which is a private computer network. In addition, a hybrid prediction strategy was utilised for the defect diagnostic as well as the defect forecasting. The latest machine learning techniques were utilised in order to model the complexity of the environment and estimate the genuine positive ratio of the quality control system. The quality control of the system was evaluated using these pieces of data.

INTRODUCTION

IOT technologies, physics, and cyber capabilities have been integrated into smart production setups so that the benefits of these setups can be realised to their full potential [1]. The overall system has been given a great deal of attention to detail in order to make it more adaptable and compatible. In order to encourage the use of cyber-physical systems, tools, and procedures in smart factories and make decision-making easier in the 4th generation of manufacturing, the German government came up with the name "Industry 4.0." [2] The enhanced speed, volume, and variety of data that big data provides are utilised by smart manufacturing. When big data technologies are utilised, analyses become more accurate, and it becomes simpler to generate predictions [3, 4]. It is essential for businesses to have the features that have been outlined above, but the costs and other particulars can change depending on the provider as well as the configuration of the system. As a consequence of this, it is possible that the capacity of certain businesses can be increased by researching the overlap that exists between other industries.

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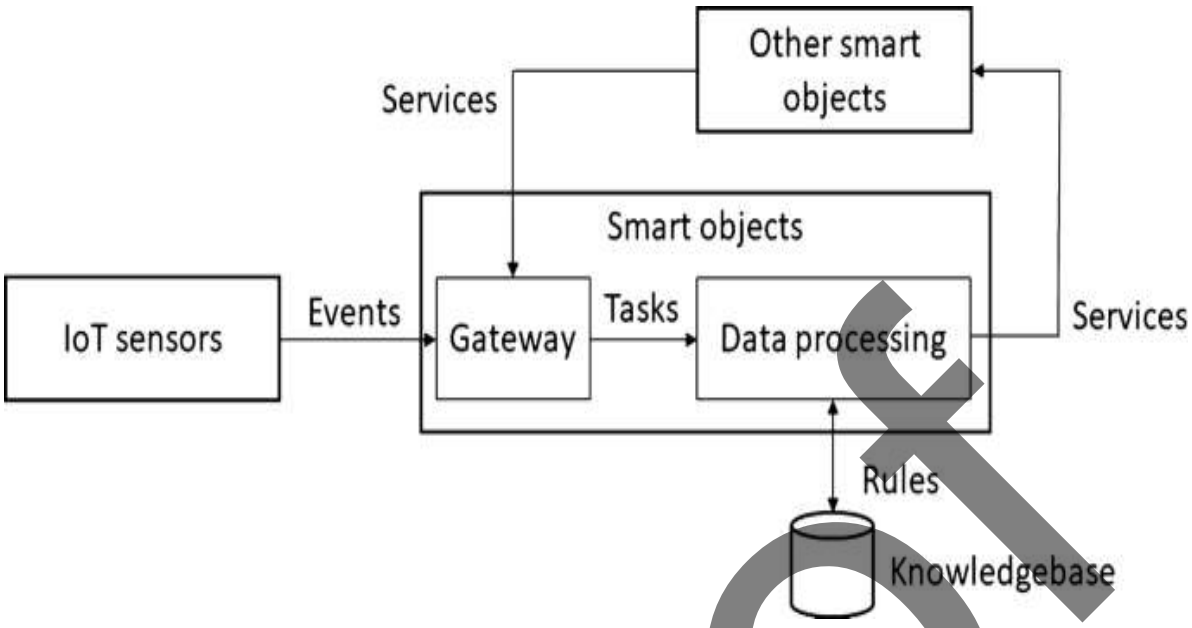

FIGURE 1. General Block diagram of Machine Learning with IOT for Smart Industrail

In recent times, there has been a lot of focus placed on the proliferation and use of IOT technologies in the financial services industry [5]. The typical applications of the Internet of Things are dependent on networks that contain smart contracts in order to transfer assets and exchange data. This technology is thought to be beneficial to a variety of different areas, including the corporate world and the manufacturing sector. The fundamental objective of the smart manufacturing initiative that is part of Industry 4.0 is to define the relationships between the many production facilities, retail locations, and other organisations that are involved [6]. This process will have an effect on both the automation and the operational optimization. Because of this, it is capable of greater adaptability, safety, and cost-effectiveness, in addition to increased productivity and profitability. Despite the fact that Industry 4.0 has a great deal of potential, its implementation has been hampered by a number of challenges that are specific to the manufacturing industry. The most prevalent sources of problems include information sharing across several devices, networking, and other similar activities [7]. The comprehensive procedure is shown in Figure 1. In this particular instance, both the business procedures of the manufacturer and those of the distributor are taken into consideration. The internal and external layers are the two components of the IOT system that have been presented for the manufacturer's transaction that are considered to be the most crucial. The manager will begin by making contact with the many parties involved in the production of the product, including the suppliers, manufacturers, and distributors. This is done in order to maintain quality control and reduce the number of errors that occur during production. The steps involved in the production of intelligent contracts have already been described. The information that is held in a given layer of the Internet of Things (IOT) can be accessed from that layer. The key point of emphasis that is placed on this layer is the decision that the producer makes on the manner in which their products are sold. After decrypting the data stored in the private layer, the author shares it with the rest of the participants. The dataset is encrypted in the same fashion using both the public key and the private key. There is no way to establish a direct connection between the public layer or the encrypted file and the private key. The transaction step of this method receives the vast majority of the attention and focus of the public layer. The first stage in managing and validating the transactions dataset is data mining, which you can read more about here. The transaction is checked for legitimacy once the data have been inserted into the sequence structure of the IOT.

The following are this paper's key contributions:

- Monitoring in real-time based on IoT ambient sensors.
- Using IOT to reduce decision-latency. making's
- Making use of IOT and machine intelligence to protect decentralized, open transactions.
- The enhancement of the manufacturing network through use of smart contracts.
- Predictive assessment relies on the manufacturing system's fault diagnosis.
- Managing the huge industrial dataset using big data approaches.

The remaining sections of the essay are organized as follows: The practical literature evaluation of the most recent industrial and technical processes is presented in Section II. The suggested manufacturing approach architecture is shown in Section III. The results and discussion are presented in Section IV, and we wrap up this study in Section V.

LITERATURE SURVEY

This section covers information on smart manufacturing and outlines some current business problems that the scientific community has been oblivious to.

In the second decade of the twenty-first century, there was a substantial improvement made in both the field of next-generation analytics and business development. Because of breakthroughs in manufacturing techniques, brand-new devices like the FinFET [8] and the shift from 2D to 3D device design have been realisable. These modifications were required due to the fact that the devices are becoming progressively more difficult to use. During the second phase, new market trends encouraged the development of electronics that were more compact, quicker, and required less power. The technology that enables these devices to communicate with one another is referred to as the Internet of Things, or IoT for short (IoT). When it comes to connecting to the internet at a home or business, the process works like this. The process of collecting and analysing data from a wide variety of sources, including customer feedback, production data, information about the firm itself, requests, and so on, has enabled smart manufacturing to significantly improve decision-making. Manufacturers have profited from the feedback of customers and other stakeholders at various stages of product development in order to improve the quality, design, and other elements of their products. The analysis of customer preferences and product deficiencies in real time using big data is a significant tool that organisations can use to improve the products and services they offer. Because of this, data-driven advertising is a more effective instrument than conventional advertising when it comes to anticipating what products should be manufactured.

Big data technologies such as NoSQL MongoDB, Apache Kafka, and Apache Storm can be utilised to process and store the data that is produced by the manufacturing industry. Using the scalable messaging infrastructure provided by Apache Kafka, it is feasible to design applications that run in real time. The system's primary benefits include its swiftness, its capacity for expansion, and its adaptability in the face of error. Several research came to the conclusion that the utilisation of data collected by sensors connected to the Internet of Things (IoT) was advantageous in a variety of fields, including healthcare. The first time it was used in medical practise was in the year [13]. The sensor data collected from the patients is stored in Apache Kafka and MongoDB by the system that has been suggested. A method called Apache Kafka was applied to the process of developing an online parking system in [14].

The Internet of Things (IoT) has brought about revolutionary changes in the areas of data security, data transit, fault tolerance, and transparency [15]. The distributed ledger is an integral part of the process that is being carried out here. The Internet of Things places a premium on safety while retaining a high degree of adaptability, decentralisation, and openness. This is one of the most distinguishing characteristics of IOTs. Bitcoin [16] was the first cryptocurrency to make this technology accessible to the general public; since then, researchers have worked to make it more practical in a wide range of industries and applications. Internet of Things (IOT) applications can be found in a variety of fields, including cryptocurrency [22], agriculture [17], education [18], healthcare [19], economics [20], and transportation [21]. According to the authors of [23], the Internet of Things has the potential to be utilised to control and track agricultural supply networks. The key objectives of this system are the management of the supply chain and the localization of products. The Internet of Things-based agricultural supply chain makes use of Hyperledger Fabric and Ethereum, which are both independent IoT network platforms. There are considerable differences in both the manner in which transactions are carried out and the amount of time required to finish them. Utilizing this technique will allow you to keep your data protected from harm. According to the information presented in [25], using a network that consists of interconnected devices can be a risk-free means to obtain data. The utilisation of IOT technology, which enables digital information to be transmitted without consent and controls the timestamp dataset that connects the services and the system, is the essential component to accomplishing this objective. To put this plan into action, you will need to obtain the necessary permissions.

Cloud manufacturing is a relatively new method of producing goods that can be adapted to meet the specific requirements of the end user. Under the proposed paradigm, distributed resource management and cyber-physical manufacturing will each be managed as a separate service. Due to the centralised nature of the cloud's architecture, there are problems with both trust and security [26]. In the manufacturing industry in [27], both public and private networks were utilised in the capacity of cloud service providers. A public Internet of Things was utilised by the provider of the service (IoT). At the level of the workshop, a private IOT was utilised. The level of the machine was

utilised so that the data could be acquired. According to [28], the absence of a moderator does not prevent a cloud-based IOT network from being able to contribute to the establishment of confidence in the network. The manufacturers expressed a wish to share some information, but the model that is now being proposed is unable to accomplish this goal. Because of this, there was an inefficiency and a decrease in the quality of the service that was provided [28].

The goal of the manufacturing sector is to create an intelligent manufacturing environment that allows for the possibility of machine learning by utilising new technologies such as the internet of things (IoT), big data, and others. The system of advanced manufacturing contains a wide variety of sensors, each of which is capable of collecting data in a different manner. The sensor data comes from a wide array of objects, pieces of equipment, activities, and sensors located throughout the environment. The primary focuses of this section [29] are conducting an analysis on a significant volume of data and making judgments in real time. They are able to identify patterns, learn on their own from the datasets provided, and carry out a broad variety of other operations. Learning by machine (ML) and artificial intelligence (AI) both [30] It is possible to enhance the product's quality while simultaneously accelerating production using a number of different tools and approaches. The following paragraphs will explain only two of the numerous applications where machine learning and artificial intelligence (AI) can be of assistance: forecasting production and performing routine maintenance. In predictive maintenance, data are used to construct systems that are capable of identifying potential issues before they manifest themselves. It is possible to monitor the productivity cycle over a period of time by analysing the data for patterns over time and then basing production estimates on those patterns. With the help of machine learning, it is feasible to obtain reliable outcomes from quality control inspection applications without the participation of humans beings (ML). The same holds true for people who operate in the manufacturing industry, as they are required to reach a consensus on the standards and procedures that will be used for freely interacting with one another. [31]'s approach to the manufacturing system has put a key emphasis on providing high levels of customer satisfaction. If artificial intelligence and information communication are combined, a factory may be able to be customised based on self-perception and intelligent decision-making in order to improve the quality of its production.

PROPOSED METHODOLOGY

The planned system's intricate architecture is covered in this section. The suggested system's design, which is predicated on IOT-based quality control, is depicted in Figure 2. The suggested system is composed of four primary layers: a business layer with multiple services, a distributed database layer, and IoT sensor layer, and a smart contract layer. Distribute the ledger for evaluating quality, assets, logistics, other transaction data safely using machine learning as well as IOT technologies. In the system described, the specified smart contract offers intelligence, privacy protection, including automation, and IoT sensors extract real-time data. The pre-processing and data analysis performed throughout this procedure uses machine learning modules.

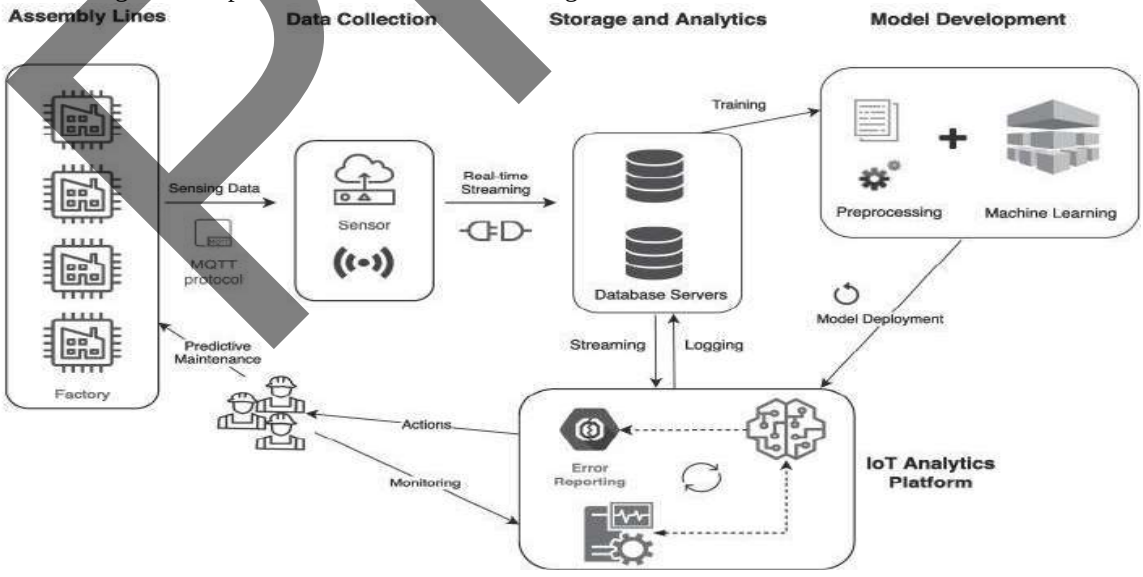

FIGURE 2. Proposed Block diagram

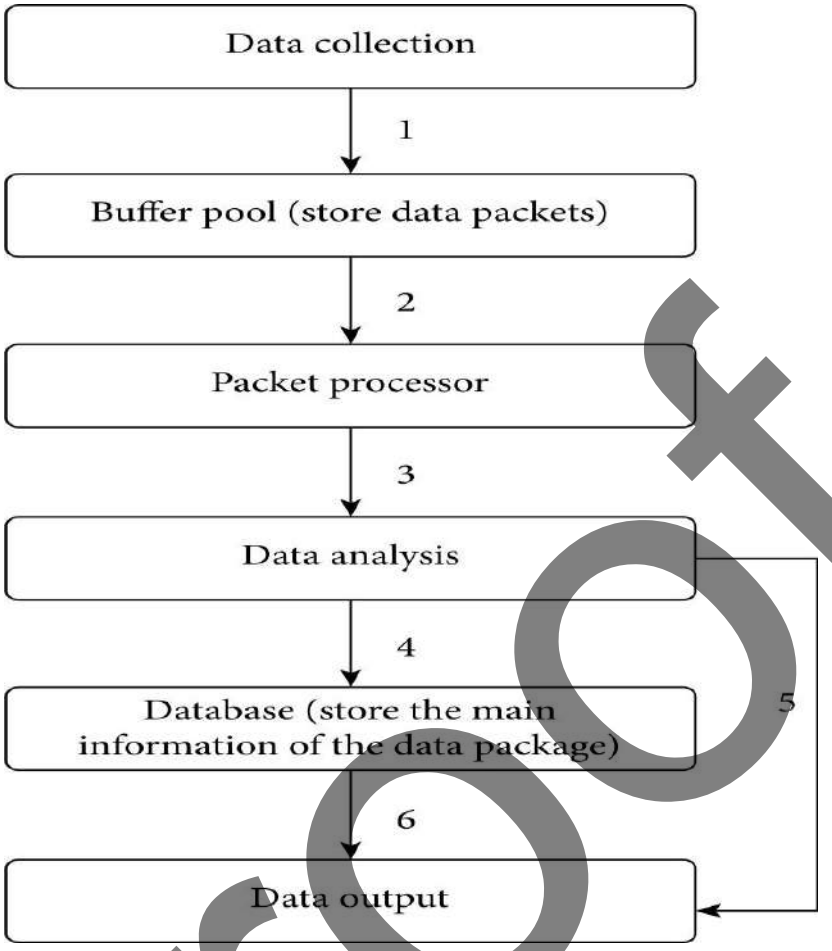

FIGURE 3. Flowchart of Proposed methodology

In order to keep track of the logistics and position data pertaining to the items, the sensor layer, which is the initial layer, uses GPS. Through the use of the Internet of Things, transactions, asset quality, and asset location can all be monitored. Barcodes can be utilised in processes where there are not many data points and accuracy criteria are not necessary because the prices of IOT are so high. In addition to sensors that measure temperature and humidity, a variety of other sensors may also be utilised in order to collect necessary data. The distributed ledger layer makes up the second tier of the Internet of Things (IOT) stack. This layer includes transactions, resources, logistics, and high-quality data as its components. Every one of these parties, including the manufacturer, the distributor, the retailer, and the owner of the banking institution that services the retailer, possesses a copy of this information. This information is utilised for the purposes of quality control and making certain that the system is operating effectively. The third layer of the supply chain is called a smart contract, and it is responsible for the collection and sharing of data. Digital identities are frequently used to set limits on who can access private information in the interest of keeping that information secure. This strategy is required to be applied whenever competitive businesses within a supply chain share confidential information with one another. The business layer incorporates each and every one of the numerous business procedures in addition to itself. In addition to this, IOT might be responsible for managing and monitoring the quality and support contracts.

REAL TIME QUALITY CONTROL

The Internet of Things (IoT) is becoming an increasingly valuable technology as the number of businesses and sectors that exist in the globe continues to grow. When organisations communicate their datasets both within and outside of the plant, security concerns might arise, particularly in relation to machines, networks, participants,

components, commodities, and logistics. The manufacturer has the ability to choose the optimal solution while minimising the drawbacks of IOT technology by providing challenges, opportunities, and industry knowledge. This ability is what determines the optimal position for IoT in each organisation, and it depends on the manufacturer's ability to identify its needs and issues. In order for the IOT technology to perform effectively across the entirety of the production process, it must at all times be understandable and trustworthy. For the purpose of achieving more transparency in the management of assets, it is essential to make use of standards, maintain quality standards, regulate firm identifiers, monitor supply chains, and track assets. The utilisation of smart contracts results in providers, manufacturers, and other relevant parties receiving notifications regarding the quality of both the real-time data processing and the product quality. The technology may be able to supply smart contracts to a wide variety of vendors by utilising digital IDs. Every component possesses both a one-of-a-kind digital identity and an identification number that is exclusive to the Internet of Things. In addition, a manufacturer is unable to read this data, which ensures that it will not be shared with other suppliers who offer similar services. Through the use of smart contracts, it is conceivable that manufacturers will be able to control the monitoring equipment.

PREDICTIVE ANALYSIS BASED ON MACHINE LEARNING

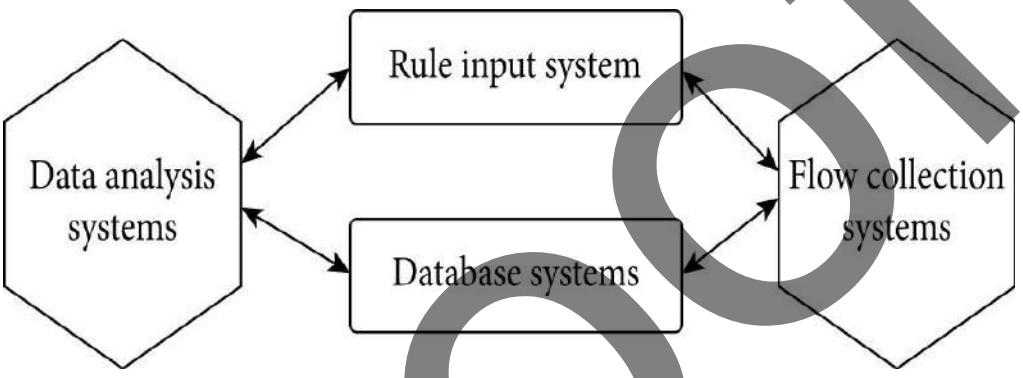

FIGURE 4. Predictive Analysis Based on Machine Learning

In the course of the last few decades, machine learning has been put to use in various industrial processes in order to foretell the future and make decision-making easier. In order for data extraction to be as efficient as it possibly can be, it needs to be able to recognise new patterns and forecasts, in addition to other pertinent data points. It is now possible to make decisions much more quickly than in the past. The method of production is directly affected in some way by each and every one of the things that have been brought up in this discussion. The major purpose of machine learning is to provide the industrial sector with a fresh point of view, which is why this field is so important. The stage of data preparation is an essential component of machine learning since it enables the user to extract the relevant information, investigate the structure, pick samples, and decide on a course of action. When it comes to the extraction and utilisation of data, it is also necessary to take into account changes in both the conditions and the tasks at hand. Only via careful data preparation and transfer is it possible to improve the overall quality of a dataset. Creating a training dataset is the first step that must be taken before deciding on the machine learning algorithm to use. When a model is chosen, the necessary parameters become available for selection. In the following stage, the overall performance will reach its conclusion. Evaluation and validation of the model's performance can be accomplished by a variety of methods, including cross validation, variable sensitivity analysis, modelling stability analysis, and others. After the dataset has been modelled and the performance has been validated, we then utilise the many ways to data analysis in order to improve our methodology. Clustering and supervision are two examples of analytical procedures, together with defect detection and diagnosis, terms of the specific, and quality. Using the fault diagnostic, any defects discovered during testing can have their causes thoroughly probed. It is possible that the fundamental cause of the problem is located within the process itself or a single sensor, according to the approach taken to diagnose faults. Following the completion of the clearing of the fault diagnosis output, the performance evaluation report is then generated. Methods of soft sensing or prediction can be utilised in order to perform an evaluation of the operation's core performance. The predictive data models have the ability to extract and supplement the online prediction process based on the link between the components that are shared by both models. On the screen will be provided a real-time prediction output that is based on regression and prediction models.

PRACTICAL BYZANTINE FAULT TOLERANCE ALGORITHM (PBFT)

Because of using the model, it is possible to obtain the income function of the attacker, as well as the income function of the intrusion prevention system, in order to build its attack and defence strategies. Additionally, it is possible to obtain the income matrix in order to obtain the Nash balance of the model based on the desired function [32]. The construction of a practical Proactive fault technique involves the combination of four tuples. Changing Equation (1) into the following equation, which represents the model RRDM through appropriate representations of the and as the revenue function of an attacker with an intrusion detection system, which represents the total number of games, is how the Byzantine fault-tolerant method (RRDM) is described.

$$R_{RDM} = (a, d; A_a, A_d; U_a(A_a), U_d(A_d), T) \quad (1)$$

Create a formula-based assault plan and defense strategy suit (1). These are the phrases.

$$S_a = (S_N, S_M, S_P, S_A) \quad (2)$$

$$S_d = (S_C, S_R, S_W, S_D) \quad (3)$$

S N, S M, S P, S A, and And in the formula stand for normal, attack, aberrant, and preattack action strategies. The letters S C, S R, S W, and S D stand for continuing execution, suggested execution, alarm, as well as protective action, respectively.

$$S_{ad} = (s_a, s_d | s_a \in S_a, s_d \in S_d) \quad (4)$$

Expressed the action strategy of both sides of the bureau.

IMPLEMENTATION OF PROPOSED METHODOLOGY IN SMART MANUFACTURES

In this section, we will provide an analysis of the results as well as an application of the integrated methodology that was proposed. The procedures and instruments that were utilised during the execution are detailed in Table 2, along with the essential preparation steps. Ubuntu Linux 18.04.1 LTS and an Intel(R) Core(TM) i7-8700 running at 3.20 GHz were the operating systems and processors that were used to implement and carry out the strategy, respectively. The docker engine must be version 18.06.1-ce, and the suitable docker composer version was 1.13.0. The IOT environment requires both of these versions. IoT technology based on Hyperledger Fabric V1.2 was utilised, together with 32 gigabytes of primary memory. Composer REST Server, a well-known CLI (command line interface) tool, was used to deploy composers when working with the Composer-Playground integrated development environment (IDE) platform. TensorFlow was utilised as the programming language for the platform.

In order to implement the predictive analysis using this method, the scikit-learn module that is part of the PBFT model as well as the programming language Python were utilised. The fundamental algorithm of PBFT, PBFT, can be of significant assistance in the analysis of non-linear and numerical datasets. As a direct consequence of utilising this method, the overfitting issue will not arise. The process of making a forecast can be broken down into three steps. In this first section, we will discuss the best practises for data collection in an industrial environment. After going through the second stage of processing, the data are then prepared to be used in the stages of manufacturing that come after them. In conclusion, the PBFT prediction algorithm is applied in order to evaluate and foresee the quality of the suggested system when it is implemented in a production setting. The seven key activities that comprise the data preprocessing segment include feature engineering, data transformation, feature comparison, dataset normalisation, feature selection, dataset division into training and test sets, and the implementation of the PBFT algorithm. Each of these activities is a part of the feature selection process.

RESULTS AND DISCUSSION

Accuracy is a statistical measure that indicates how successfully a system recognises or ignores a binary classifier. The accuracy of this procedure was evaluated with the help of Equation 5, which was applied. The terms "true positive," "true negative," "false positive," and "false negative" are represented by the letters "Xa," "Xb," "Ya," and "Yb," respectively. A strong indicator of a solid performance is high accuracy on the hit. The outcomes of various machine learning algorithms are compared in Table 1, which illustrates how the suggested method stacks up against its competitors. The hardware and software specifications are listed in Table 2.

$$Accuracy = \frac{X_a + X_b}{X_a + X_b + Y_a + Y_b} \quad (5)$$

Equation (6) assesses this procedure's recall. The ideal indicator for choosing a model is the recall, which displays the genuine positive proportion that was properly detected.

$$Recall = \frac{X_a}{X_a + Y_b} \quad (6)$$

Equation (7) assesses the accuracy in light of the determined accurate and positive values. Similar to that, it calculates the expense of false-positive scenarios.

$$Precision = \frac{X_a}{X_a + Y_a} \quad (7)$$

TABLE 1. Comparable results of machine learning algorithms

Model	Training (s)	Prediction (s)	Accuracy (%)
Logistic Regression [33]	2.187	1.881	60.40
Naive Bayes [34]	1.484	1.682	68.50
KNN [35]	1.412	1.518	80.20
XGBoost [36]	1.219	1.312	91.73
Proposed PBFT	1.115	1.112	99.16

TABLE 2. Experimental environment

Tool's	Component's	Specification's
Hardware	CPU	Intel(R) Core (TM) i7-6500U @2.60 GHz
	Memory	8 GB RAM
Software	Operating software	Window 10
	Simulation Software	Pycharm 2019.2 (Python 3.8)

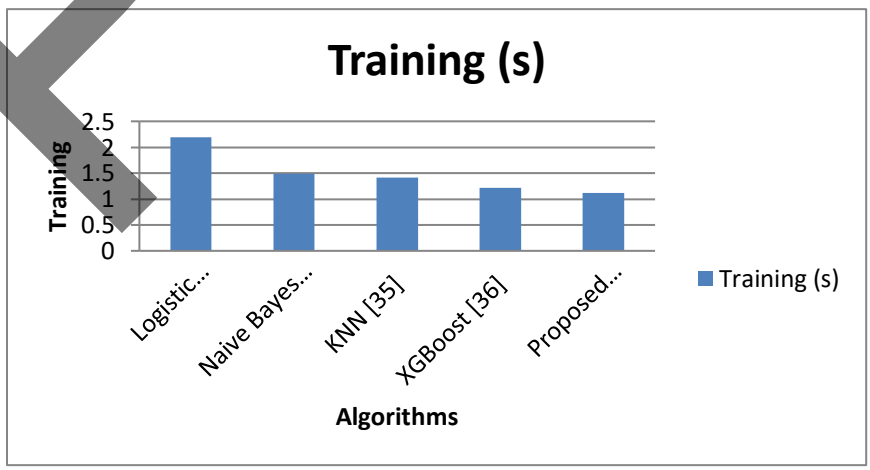

FIGURE 5. Comparable results of machine learning algorithms for Training (s)

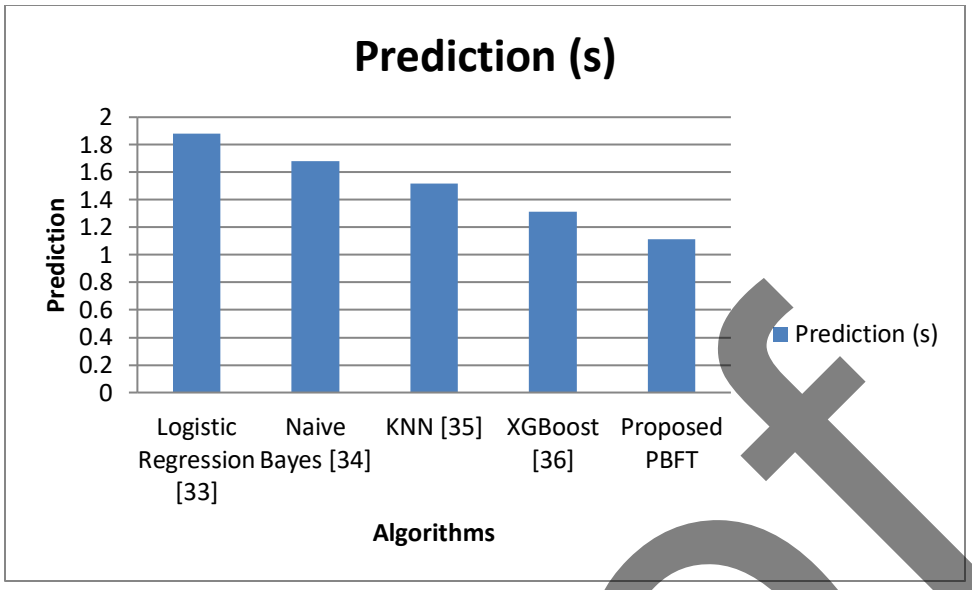

FIGURE 6. Comparable results of machine learning algorithms for Prediction (s)

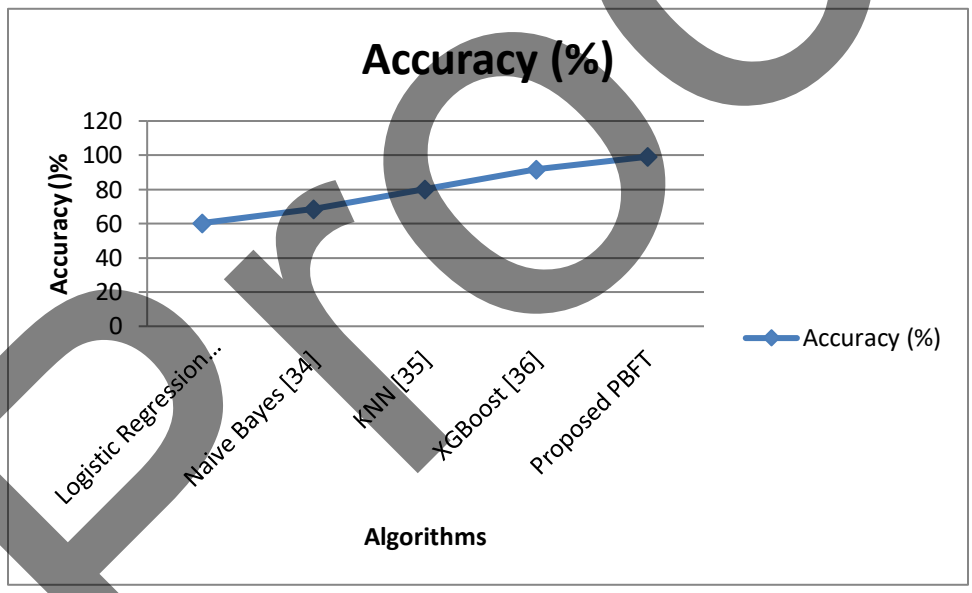

FIGURE 7. Comparable results of machine learning algorithms for Accuracy (%)

The smart manufacturing sector using machine learning plus IOT is presented. The outcomes of machine learning techniques for trainings, predictions, and accuracy are shown in figures 5, 6, and 7. The manufacturer may add, edit, and remove product information in the intelligent production management system over the IOT network. In order to enter new information, the manufacturer must complete the online form as well as all IOT network entries. Users may update their data on the IOT network in a similar way by sending a preferred method through the user interface. The suggested system's transaction history gateway for the IOT network is shown in Figure 4. The transaction history so all of the actions taken on this site are connected to the transactions offered. Dates, timings, entry kinds, participants, and activities are all included in the data. Similar to that, the network's transacted file system details are also given.

CONCLUSION

The purpose of this project was to investigate a number of different machine learning and internet of things-based approaches to multistage quality control. The correctness of the categorization was used as a criteria for doing the data validation. A comparison of PBFT with other machine learning approaches reveals that the complicated correlations derived from the dataset can be utilised to do an evaluation of the data set's overall quality. The solution that was provided was successful in enhancing the environmental quality of smart manufacturing processes and obtaining desirable results because it made use of an Internet of Things (IoT) and machine learning (ML). With the assistance of this technology, users and manufacturers can make their environments of work more trustworthy and secure. By extending the scale of the network, we will be able to test and evaluate the operation of the system in increasingly complex industrial scenarios with high precision, machine learning models, and other types of applications.

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Intelligent Robotic Process automation that shall make captcha security ineffective

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Abstract-- Evidence of human interaction is essential before granting access to publicly available resources to ensure protection from perpetrators. CAPTCHA, one of the major technologies used all over the world, ensures security by having users solve CAPTCHA, which is said to be "easy for humans but difficult for computers". Image-based CAPTCHA classes that appear on various websites are difficult to resolve and time consuming for humans. Based on the evaluation of the request by the "advanced risk analysis system", it is possible to return a capture of some difficulty. This needs to be resolved by the user by clicking the checkbox or identifying images with similar content. Conduct a comprehensive reCAPTCHA survey to investigate how each request affects the risk analysis process. Through extensive experimentation, we identified vulnerabilities that allow attackers to easily manipulate risk mitigation techniques, circumvent dimensions to be incorporated to extent the envelope of security protocols, and launch large-scale attacks. The future of CAPTCHAs depends on exploring new directions to break CAPTCHAs.

INTRODUCTION

Web services are vulnerable to bot-initiated denial of service (DoS) attacks. Bots are designed to target such services and make them unavailable to their users. The key to preventing this attack and making the service available to real users is to serve humans only by providing evidence of human interaction. This widespread use of automated bots to expand the scope of online fraud has made the use of CAPTCHAs necessary. CAPTCHAs are a valuable defence mechanism when fighting scammers, as they can be used to prevent bots from accessing the server and flooding it with connection requests[1].

Traditionally, CAPTCHAs were created as distorted text stored as blurry images, making it difficult for computer programs for scanning it rightly in real time. Normally, the capture should be resolved within 1 minute and then updated. Therefore, an algorithm aimed at decoding a capture should supersede in limited time. Comparing with other technologies, CAPTCHA can be viewed as wargame between a malicious user, his program and security designer. Both always try to betray each one, resulting in significant improvements in optical character recognition and are said to be nearly 100% successful in decoding CAPTCHAs. On the other hand, the greater the distortion, the harder it is for the target audience to understand. Therefore, security designers come up with their own elucidation to avoid this issue. Out of them was proposed by reCAPTCHA, to use loosely coupled CAPTCHAs that aren't practical for bots and are very easy for humans to solve. reCAPTCHA did the same by examining a model that takes the user's real time behavioural argument. So challenging CAPTCHA will only be issued if you think a bot that the server may be trying to connect to. This newer idea has proven to be robust and straightforward so far. The reCAPTCHA model typically guarantees security by providing a series of images and a textual description of the way to handle the series of images. the subsequent image shows an example of reCAPTCHA[2].

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FIGURE 1. ReCAPTCHA Model

If you select all the orange images, the user will be granted access to the service. So, the typical text entered CAPTCHAs seems fuzzy, and automatic robots could surely dominate the underground CAPTCHA solving economy. The reCAPTCHA used by Google focuses to address the above risks and ensure a secure system.

EXISTING SYSTEM

Inventing a system that ensures a safe and secure access to all the legitimate users is of absolute necessity. The system designers/breakers and makers together contribute to this making of the system. So, an alternate approach to this situation could be that without any trace of exploit, there wouldn't be any upgrade in the existing system as it was deemed as perfect, unbreachable and secure but the loopholes that were later discovered and exploited paved a way for a development in the security system. Similarly, our aim here is based on this alternate approach which focuses on figuring out loopholes in reCAPTCHA if any, to encourage the development of a more secure system. The intention is to prove the same and be a small part of the reason behind the resultant growth.
Current reCAPTCHA system:

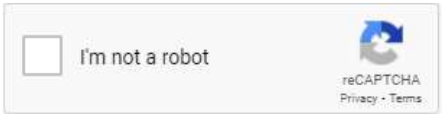

FIGURE 2(a). Before Input.

FIGURE 2(b). The Output.

Widget: When you visit a re-CAPTCHA protected website, you will see the widget (see Figure 2 (a)). The widget's JavaScript code is obscure to limit third-party review. When it loads, this will scrape the data from client's browser and sends to the server. In addition, this also does numerous checking to validate the client's browser and look for well-known automated solutions.

Workflow: When the client selects the checkbox, it contains (i) referrer, (ii) site key for the website (provided when signing up for reCAPTCHA), (iii) google.com cookie, and (iv). The request will be sent to Google. Information (encrypted) created by the widget side [1]. If the client logs in to a Google account, it will also include an additional information containing the client's authentication cookie. The advanced risk analysis framework examines the requirements to determine what form of capture challenge that will be given to the client.

Ideal solution: The challenge should be resolved within 55 seconds after being given to the user. You cannot proceed without solving the challenge unless the popup closes, and the user must click the checkbox again to get the new challenge. When the user clicks, the token is entered into an HTML field called a reCaptcha token. The token is sent to the website when the requested action is performed, and the user's session expires in 2 minutes. The token will be invalidated by Google 2 minutes and 10 seconds after it is created. If the validation fails, the error code provides more information. Based on the trust level assigned to a particular request, Google's advanced risk analysis system selects the type of challenge it presents to the user[2].

PROPOSED SYSTEM

The solution is based on Selenium, framework for robotic automation for browser [4]. The reason for using Chrome WebDriver is it takes advantage of the rich features of the browser engine and can cover all the aspects of the web page needed to bypass the reCaptcha browser check. WebDriver provides functions for finding specific elements on a page, functions to execute scripts, and drivers to monitor I/O events. Persistent Google tracking cookies will monitor the storage and mounting of cookies as they are a primary component of Google's advanced risk analysis process while providing reCaptcha challenges.

Cookie Manager: Helping to establish the fact that it is high is high, but if the system is only extended to break the legitimate user's reCaptcha, then the user already has a legitimate human-like browsing pattern, so that's not the case.

Record Collection: The reCAPTCHA Demo is a demo website by Google for testing reCaptcha, and even this website blocks challenge requests after multiple challenges are requested [4]. Using a VPN solves the problem, so VPN is enabled and the Selenium WebDriver has been enhanced to automatically access websites. Some challenges were requested, the generated images were downloaded, and their names saved as clue images to choose from. The image is then split into nine candidate images under various clues.

reCAPTCHA Breaker: This component is for collecting reCaptcha challenges. From the images downloaded with the dataset generation steps and clues, these images were added to up to 90,000 images, and depending on the image clues, a separate model was created for each clue as follows: "Fire hydrant", "bus", "car", etc. The reCaptcha breaker module then goes to the demo website and requests a challenge. If the challenge you receive contains a 3x3 image, image hints will be collected. When you select an image, the image is downloaded, split into nine images, and then all the images are sent to each model. The model returns a predicted value from 0.0 to 1.0. Here, 0 means that the image is not needed, and 1 means that the image is needed. Depending on the predictions, images are selected using the rich features of Selenium WebDriver.

Model Training: TensorFlow, the most popular Machine Learning library developed by Google is open source,

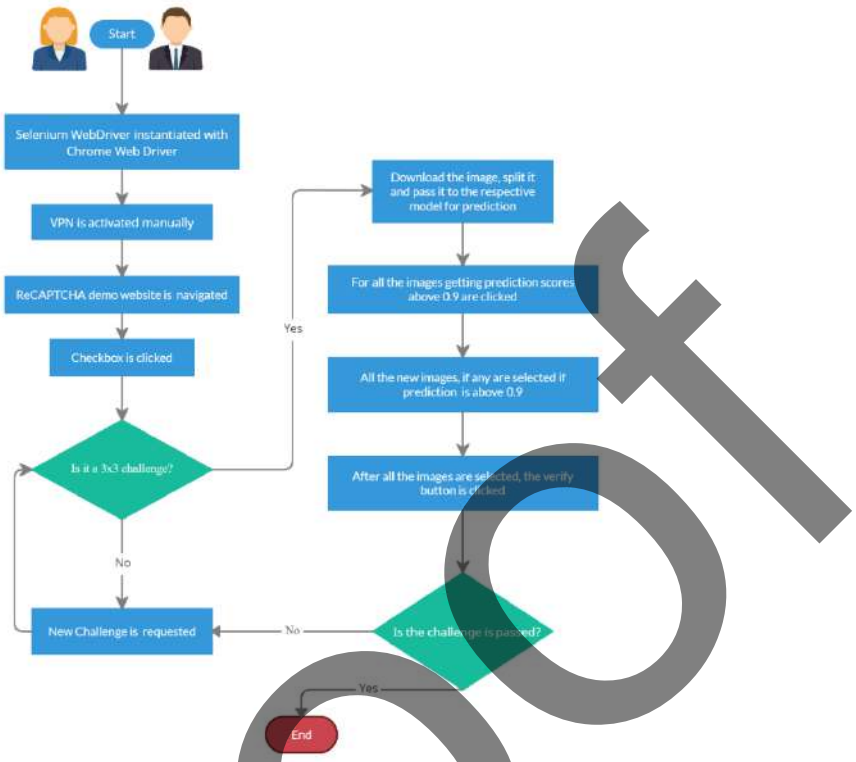

FIGURE 3. Flow Chart of the System

free and the most widely used library in this field for a range of tasks and research purposes. Keras, also a library developed by a Google engineer is based upon TensorFlow at the backend and acts as a great interface for TensorFlow with great intuitiveness, easier implementation, and great user-friendliness. It is able to harness the power of TensorFlow but is more user friendly for artificial neural networks and fast experimentation with Deep Neural Networks. If the need arises, the project built on Keras can be easily migrated to TensorFlow. Therefore, we decided to build our deep learning models on Keras [4].

For every image hint, separate models were created. The frequently occurring image select hints had a good and diverse dataset of around ~14K images while the rarely occurring challenges hardly has ~1K images. The dataset was then divided in three different sets, namely, training, validation and testing sets in the ratio of ~65%, 30%, 5% respectively. The models were trained on Google Colab with the help of Keras library. The models were trained on the testing set with a lot of experimentation with convolution networks, like tweaking the number of layers or the size of layers, activation functions, optimizers and the resulting model having the highest validation accuracy and low validation loss was chosen. The models are trained over and above a pre-trained convolution network on ImageNet database, i.e., the VGG-16 model for better feature extraction [4]. Some experimentation lies within the pre-trained model chosen which can further increase the accuracy and lower the loss scores. Of all the models trained, some models have scored very well and give better accuracy while the others don't and there lies more experimentation with these models to further make them better to gain better results. The model training was done on the highest-end GPU available from Google Colab.

METHODOLOGY

The system is completely automated with the use of Selenium Web Driver. Initially, the Chrome Web Driver is instantiated, and Google's reCaptcha website demo is browsed. The web browser is instantiated with a Touch VPN extension which can't be activated automatically with any automation but must be activated manually. After the activation of the VPN, the shell already has a prompt asking if the extension is activated. After activating the extension, enter key is to be pressed in the shell. The reCaptcha checkbox needs to be clicked for getting the challenge which is done and then a new widget appears presenting the challenge. The challenge presented has an image selection hint which denotes the type of images to be selected. The challenge can be a 3x3 challenge which has 9 different images or a 4x4 challenge which is a single image split up into 16 2D image space. The system is currently built only for solving 3x3 challenges. If the received challenge is a 3x3 challenge, the images are passed to the respective model depending upon the image select hint. If the challenge isn't 3x3 challenge, then a new challenge is requested by clicking on the new challenge button. The images are passed to the model for getting prediction scores. It starts with the top left corner image and then moves to the right and then to the next row. The scores are between 0 to 1 where 0 indicates negation and 1 indicates that the required image exists. If the prediction is above 0.9, the image is selected, and the system waits for 3 seconds if any new refreshed image is presented. If refreshed image is presented, this image is then again passed to the model for prediction, and this is looped until the refreshed image is not to be selected and then it moves to next image. After completing all 9 images with predictions, the verify button is clicked to see if the system was able to break though the reCaptcha. If it was successful, the system asks if it should demonstrate breaking another challenge. If it wasn't successful, it reattempts to break it with a new challenge. These are the methods in which the system attempts to break through the reCAPTCHA

RESULTS

IMPLEMENTATION

Individual models that were trained for all the different selection criteria such as cars, fire hydrant, bus, etc. The models that had a diverse and huge dataset of more than 12k images achieved good accuracies with 92% being the least of them (for a particular model). Apart from the frequently occurring challenges that resulted in good datasets, there are a few other challenges which rarely occur so in turn had a smaller and less diverse dataset of around 1K images. This made it a lot more difficult to train the datasets and achieve a good accuracy and so the models struggle with these challenges which could be further improved. The model can accurately validate all the 9 candidate images within a span of less than 2 seconds but doing this is unhuman and can then be easily understood as a bot attack preventing the challenge to be passed even when all images selected were correct.

Overall, the system selects images with an accuracy of more than 90% but a recent update to the reCaptcha system has made it harder to break it as even though the images are selected correctly, the click movements are observed as well making it harder to pass the challenge. This could be improved in the future.

From the point of view of sites employing such challenges, click movements is a great study that could be used to prevent bot attacks.

SCREENSHOT

All the models are pre-loaded initially while parallelly instantiating the WebDriver and the VPN is to be activated manually (since there is no way to control the extension behaviour). Then the browser is navigated to the site https://www.google.com/recaptcha/api2/demo and then it waits for the user input to verify that the VPN is activated to proceed with the breaking.

The driver than clicks on the checkbox and a challenge is presented within an iframe and then it is navigated to the frame for solving the challenge.

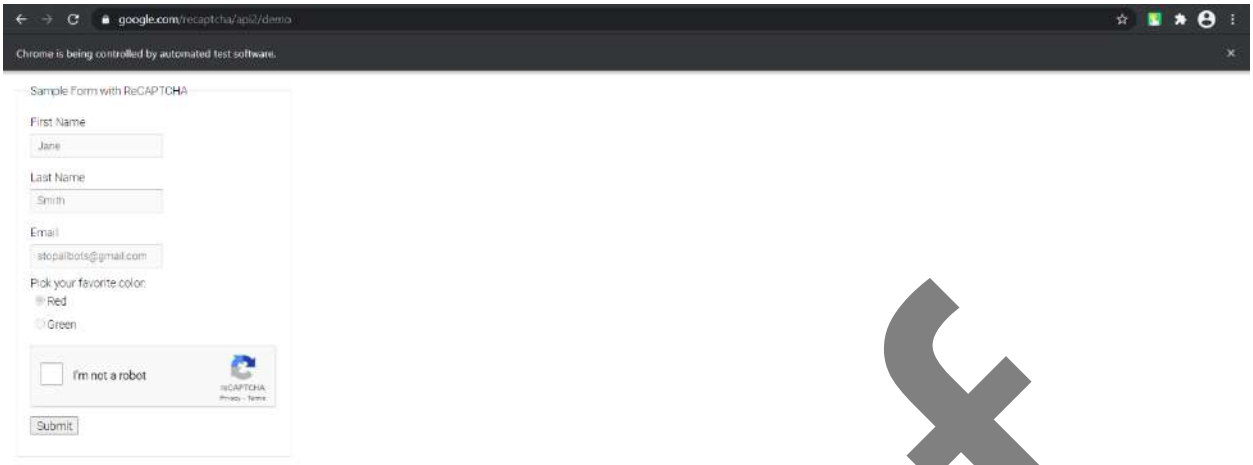

FIGURE 4.1. reCAPTCHA Website Instantiated

Upon being presented with the challenge, the type of challenge is checked. If it is 4x4, another challenge is requested and if it is 3x3, it reads the image hint that is to be selected. According to the image hint presented, the model respective to that hint is passed with the images and accordingly the model returns the confidence scores in the range of 0.0 to 1.0 with 0.0 and 1.0 for least confidence score and highest confidence score respectively. If the score is above 0.5, the image is selected and then a delay is introduced to look for another image as well as it is required so that the system doesn't doubt for it to be a bot.

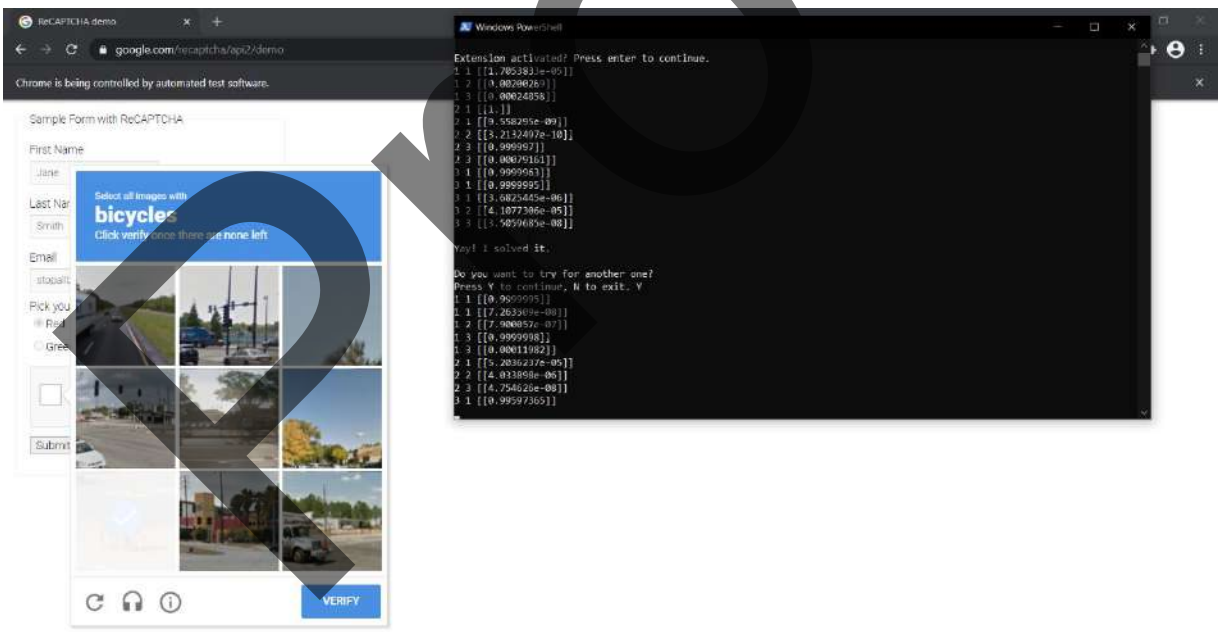

FIGURE 4.2. Solving the challenge presented

After all the images are selected and the model predicts no more images are to be selected, it then clicks on the Verify button and then the system judges if it is confident enough that the challenge solved did not have any bot like characteristics and the challenge was solved accurately enough as well, it returns with the challenge passed and if not, another challenge is presented with the error as "Please try again."
If there are multiple failed attempts, the system blocks the IP for a stipulated time to prevent any unauthorized attacks.

The system built by us though solves the challenges 7-8 minimum number of times accurately out of 10 and therefore has very slim chances for being blocked.

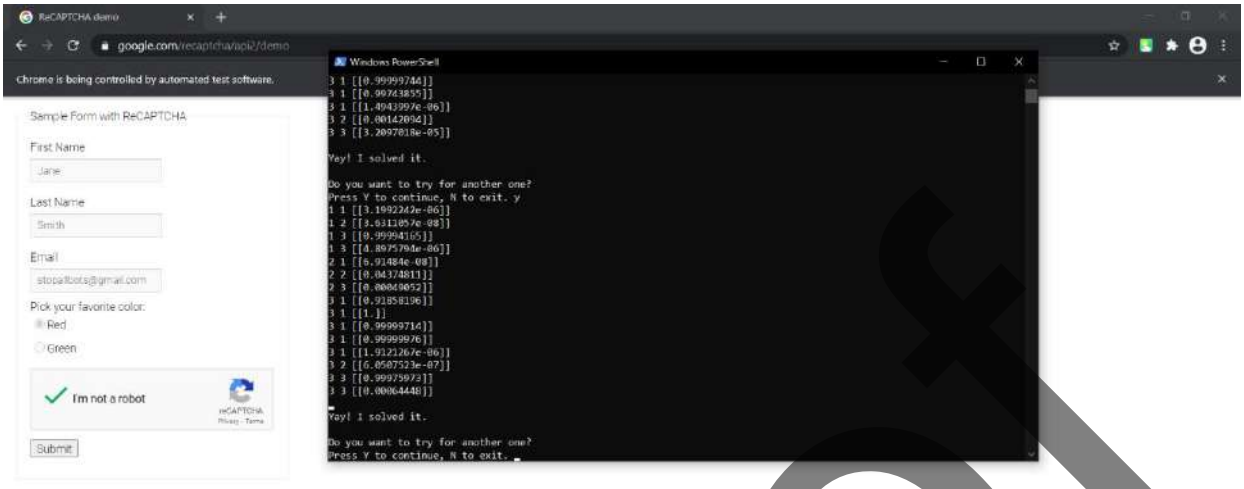

FIGURE 4.3. Successfully solved the reCAPTCHA challenge

FURTHER DISCUSSION

The proposed system currently only targets 3x3 image challenged and not 4x4 challenges. The 4x4 challenges comes under the domain of "Object Detection". From the experiments conducted, it was observed that the 4x4 challenges accordingly are a level lower to 3x3 challenged, meaning that the user might be asked to solve more than one 4x4 challenge in most of the cases even when it's accurately marked compared to solving a single 3x3 challenge provided it's solved accurately. So, the system can be further extended to solve 4x4 challenges. Dataset collection method remains the same as mentioned but labelling the dataset would be a cumbersome task.

The datasets for the frequently occurring challenges is quite huge and diverse and so apart from the methods mentioned to train the model, there can be furthermore experiments that could be implemented rather than using a 'one for all' kind of model to train the dataset and have a more model adaptive to the type of data.

Clicking mechanism is something that an automated bot is going to lack considerably, and imitating human cursor movements is a task and there is a huge scope for experimentation and improvement here.

CONCLUSION

The system achieves an overall accuracy of 75% on an average to break the reCaptcha for 3x3 challenges. The image selection accuracy is more than 90% on an average but the problem lies with the clicking mechanism. The cursor movements and clicks tend to be detected as a bot which in turn makes the risk averse system detect the system as suspicious even if the challenge is accurately solved and might present another challenge to be solved which lowers the solving accuracy of the bot. Experiments with the clicking mechanism would lead to better accuracies and lies in the future scope of the system.

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Role of Artificial Intelligence for the Curative Field: A Review

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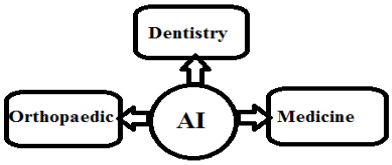
Abstract. Artificial Intelligence (AI) is a technological know-how or era that may be applied to show a simple machine right into a clever machine. Making or designing a machine that thinks and works like a person is mentioned be intelligent. We can witness the evolution of computers, from the primary mechanical computer, the "Babbage Difference Engine," to the Supercomputer "Fujitsu Fugaku," way to AI. E-commerce, navigation, robotics, human resources, healthcare, agriculture, gaming, automobiles, and quite a few different regions have all benefited from AI. AI is carried out in Emergency Medicine to growth operational efficiencies, surgery, and healthcare quality. When it involves illnesses like COVID-19, AI is used to represent the tissues of sufferers and classify the severity of infection. When it involves cancer, genomic sequencing can resolve all mutations that force person tumors, so AI is used to seize the genetic make-up of person sufferers and shape personalised medicine. AI is utilized in pharmacy to layout tablets and higher information of contamination heterogeneity. It not only identifies healing targets, however additionally designs and optimizes drug candidates. Computation Formulation of Orthodontic Referral Decision (CFOD) is an artificial intelligence (AI) idea applied in orthodontics to help decision-making for orthodontic diagnosis. In this paper, we aim to discuss the role of AI in Health care, such as Dentistry, Medicine, Emergency Medicine, Orthopaedic, Pharmacies, etc,.

INTRODUCTION

Artificial Intelligence: Artificial intelligence become based as an educational subject in 1956, and in the years in view that has skilled numerous waves of optimism, observed with the aid of using and the lack of funding (called an "AI winter"), observed with the aid of using new strategies, fulfillment and renewed funding. AI studies has attempted and discarded many exceptional strategies in view that its founding, which includes simulating the brain, modeling human hassle solving, formal logic, big databases of know-how and imitating animal behavior. In the primary many years of the twenty first century, fairly mathematical statistical device mastering has ruled the field, and this method has proved fairly successful, supporting to remedy many difficult issues during enterprise and academia. Artificial intelligence (AI) is intelligence tested with the aid of using machines, in preference to herbal intelligence displayed with the aid of using animals which includes humans. AI programs encompass superior internet seek engines (e.g., Google), advice systems (utilized by YouTube, Amazon and Netflix), know-how human speech (including Siri and Alexa), self-using cars (e.g., Tesla), computerized decision-making and competing at the very best degree in strategic sport systems (including chess and Go).



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a. Role of AI in Dentistry: Artificial intelligence (AI) and, specifically, deep learning, as an example the use of convolutional neural networks (CNN) were correctly hired to evaluate curative field imagery. AI has additionally been hired for dental image analysis, e.g., landmark detection, teeth class or healing segmentation on photographs, radiographs or floor scans in addition to pathology detection on radiographic, transillumination or photographic imagery. From a computational perspective, orthodontic analysis and remedy making plans lends itself to pc programming and modelling such as artificial intelligence. Diagnosis is completed through the professional device primarily based totally on affected person data. An professional device prediction method makes use of set of rules that estimate an unknown dependency among a hard and fast of given enter variables and its output variable and predicts outcomes. The set of rules may be utilized in an extensive kind of software wherein it's far tough or unfeasible to increase traditional algorithms to fragrance the wanted responsibilities inclusive of in healthcare analysis and remedy making plans. A kind of packages for artificial intelligence has been mentioned in dentistry and in orthodontics such as extraction as opposed to non-extraction decision-making and to decide the want for orthodontic remedy.

b. Role of AI in Medicine and Emergency Medicine(EM): AI- primarily based totally predictive modelling is rising as a modern answer to enhance each capacity and velocity of medication design. AI-driven predictive models may be generated via way of means of the use of unique units of facts to tell a sequence of selections taken at some point of drug discovery, development, and registration steps.

c. Role of AI in Orthopaedic: The AI approach can assist the health practitioner to make a diagnosis or decision. In the United States, the IBM Watson Health cognitive computing machine (IBM Corp., Armonk, NY, USA) has used ML processes to create a selection help machine for the treatment of cancer, with the goal of enhancing diagnostic accuracy and decreasing expenses the usage of huge case volumes. Clinical selection help structures additionally offer guidelines at the analysis and remedy of low back pain; those structures can classify subjects, and in addition development may want to allow the mixture of AI plus clinician to make greater rigorous classifications than human selection-making alone. Thus, AI can also additionally allow greater correct allocation to offerings within the future, at the same time as growing the accessibility and velocity of self-referral.

RELATED WORK

Dentistry: In primary public oral fitness centres', orthodontists, standard dentists and paediatric dentists are frequently observed operating collectively within the equal organization, for this reason facilitating joint motion and a flexible work division.

An AI professional device version referred to as the computational Formulation of Orthodontic referral Decision System (CFOD) was created that might system analyze the different factors and variables concerned and make the vital orthodontic referral selections primarily based totally upon pre-remedy malocclusion conditions.

The AI version changed into verified towards 15 fairly skilled orthodontist "experts" with extra than eight years of experience. 221 cases with loads of malocclusion traits had been evaluated through the "experts" to decide the need for orthodontic remedy and referral to an orthodontist.

Results of the "experts" critiques had been as compared to the Computational Formulation of Orthodontic referral Decisions device (CFOD) with a view to validate the overall performance accuracy of the AI version. If CFOD recommendation coincided with the professional orthodontist recommendation, the case changed into labelled "coincided".

After the accuracy of the version changed into verified with the validating data, the CFOD device changed into applied on the equal number one dental healthcare facilities via persevering with training classes. The CFOD represented a version to expect the want for orthodontic remedy referral.

Medicine and EM1: AI can be used to assist with the design, implementation, and monitoring of clinical trials that evaluate the effectiveness and safety of drug candidates, with the aim of improving success rates. Although it is difficult to produce a drug using a complex molecule containing more than 10^{40} molecules. Therefore, the drug development process is limited due to the lack of advanced technologies. AI plays an important role in the structural validation of the target drug and in the optimization of the drug structure. The machine learning model was trained with various datasets of existing molecules.

AI-based algorithms can create a drug designed with desired properties. For structure-based drug discovery, the 3D structure of the protein is more important. So, with the help of AI-based tools, the process becomes simple and precise. The algorithm used in drug design must contain the SMILE sequence, molecule description, potential energy

measurement, and electron density around the molecule. A deep learning-based algorithm is used to design a histogram to predict the solubility of a molecule.

DISCUSSION

a. Limitations and challenges: AI itself have some challenges and limitation, when it comes to medical field it became more limitation. If we want to apply AI for Robot who can do operations, it will become difficult, because AI doesn't take emotions. But still it have money things that can be used in this field, like CFOD. The system which can create precise medicine.

b. Future predictions of AI in medicine: Using all knowledge of AI and medical terms and field, it can be used to generate precise medicine for each and every person.

c.

CONCLUSION

An AI expert system known as the CFOD was created, established and carried out that could offer a choice – making professional system for orthodontic analysis and referral.

An AI professional system for orthodontic, affected person referral can enhance the performance of a huge public oral healthcare system.

Considering remedy improvement as a succession of essential choice to be made to pick the proper target, drug, dosing regimen, and affected person, it seems apparent that AI can aid every of these choice through shooting the price of huge and multimodal data into beneficial predictive models.

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Review of Analysis of ECG Based Arrhythmia Detection System Using Machine learning.

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Abstract. The majority of heart illnesses can be diagnosed by analysing the ECG signal for arrhythmias. The P-QRS-T waves in an ECG signal represent one cardiac cycle. Due to varied aberrant rhythms and noise distribution, extracting powerful features from raw ECG data for fine-grained illnesses classification remains a difficult task today [1]. Previous research has primarily relied on heartbeat or single scale signal segments for ECG interpretation, ignoring the underlying complementing information of several scales. This suggested study addresses several methods and transformations that have been previously described in the literature for analysing an ECG signal and extracting features from an arrhythmia analysis.

INTRODUCTION

Every year, more than 300 million clinical ECG records are created in hospitals around the world. An electrocardiogram (ECG) is a vital tool that may record the electrical activity of the heart over time. The easiest, most practical, and least expensive method of routine examination is the ECG. It is frequently used for clinical medical screening of many cardiac illnesses, including determining arrhythmia, identifying myocardial ischemia, and reflecting the anatomy of the heart. It also gives doctors crucial reference material. The significance of autonomous diagnosis has grown in relevance with the emergence of Healthcare 4.0 and the development of Artificial Intelligence (AI). Automated ECG analysis not only gives supplemental diagnostic data but also has the ability to continuously track the health of the heart, which is useful for mobile patients. The electrocardiogram (ECG) is a recording of the electrical activity of the heart's myocardium during a single cardiac cycle. It is depicted by a recurrent sequence of P, QRS, T, and a conditional U wave, which stands for the rhythmic depolarization and repolarization of the myocardium related to the contradictions of the atria and ventricles throughout each heart cycle. In order to obtain a general understanding of the heart's activity, an ECG is recorded by placing anodes on the body's surface and using a conventional 12 lead framework.

One of the most important methods for diagnosing various cardiac conditions is the ECG. The numerous ECG components, such as the PR, QRS, QT, ST, PR, and ST segments (Fig. 1), are utilised to infer information about the cardiovascular state. The special computer assisted in isolating these time plane components from the digitised ECG data and examining the process targets. The R-peak and the detection of QRS complexes provide the fundamentals for almost entirely automated ECG analysis techniques.The ECG signal provides the following information of a human heart,

1] The position of the heart and the size of its chambers in relation to one another
2] Origin and spread of impulses
3] Disturbances in heart rhythm and conduction
4]Amount and site of myocardial ischemia (number 4)
5]Changes in the concentrations of electrolytes
6] The heart's reaction to drugs

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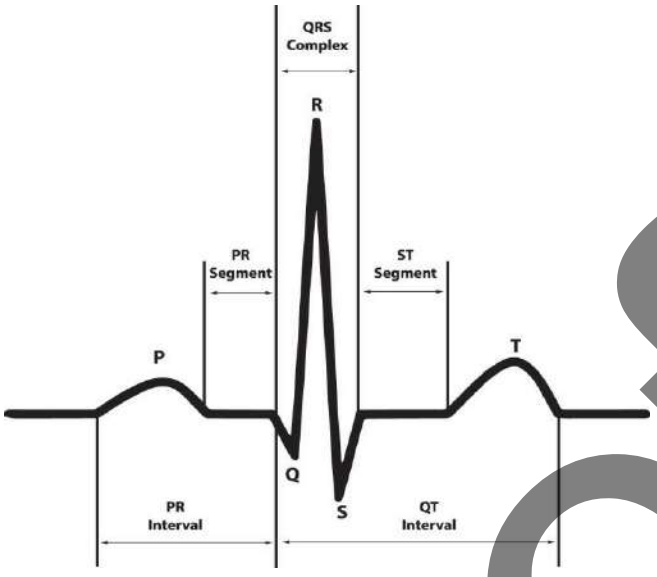

FIGURE 1. Schematic representation of an ECG wave

Making an accurate diagnosis for ECG arrhythmia illnesses is currently difficult for many cardiologists. Additionally, the traditional method of visual analysis is more difficult and takes practise and time. Different forms of heart disorders can be identified using the data from an electrocardiogram. As a result, difficulties will arise when employing wavelet transform to assess distinct arrhythmias in order to determine how effectively the patient is responding to treatment. According to the literature, the accuracy of ECG arrhythmia analysis ranges from 90 to 98%, so we are attempting to achieve 100% accuracy in arrhythmia analysis by employing the wavelet transform approach.

LITERATURE REVIEW

The Pen Tompkins Algorithm was researched by P. G. Patel et al (efficient method for ECG Signal Analysis that is simple, accurate, and requires little computation time). The MIT database's ECG signals are used for analysis. The diagnosis of an arrhythmia, which is demonstrated by tachycardia, bradycardia, asystole, and second-degree AV block, depends on the peak detection. Additionally, the findings demonstrate that arrhythmias based on an increase or reduction in the number of QRS peaks or an absence of QRS peak can be identified from detected QRS peaks.

A.R. Saheb et alanalysis .'s of the construction of a heart diagnosis tool using only a few intricate computations. The RBBB, LBBB, and normal cardiac rhythm are three separate arrhythmias for which the developed classifier has accuracy of 98%. Choi-willams distribution, Bessel distribution, and born Jordan distribution are applied for analysing supra ventricular ECG signals, and according to a Dliou, alatifet. al.[3] performance comparison study of three-time frequency techniques are applied for analysing supra ventricular ECG signals, the Choi-willams technique performs well compared to other time-frequency techs.

A fahoumet. al. [5] Arrhythmias of the heart, such as ventricular and atrial arrhythmias, are a common cause of mortality. These anomalies in cardiac action may result in an abrupt death or heart injury. An arrhythmia classification system is described in this study. The suggested approach analyses the ECG signal in time domain using nonlinear dynamical signal processing methods. The attractor distribution in the reconstructed phase space is used as the basis for the classification method (RPS). The classification characteristics of the whole classifier are determined by the behaviour of the ECG signal in the rebuilt phase space. Data sets from the MIT database are used to assess the performance of the provided classification system. The suggested technique is designed and tested using two types of data: learning and testing datasets. The learning dataset is utilized to fine tune the parameters of the selected features

with a classification sensitivity and specificity of 100%. To evaluate the suggested technique, 45 signals were employed, yielding 85.7–100% sensitivity and 86.7–100% specificity, respectively.

V Mahesh et.al.[6] has studied logistic Model Tree (LMT) classifier is used in this article to create a diagnostic system for cardiac arrhythmia classification using ECG data. The intervals and amplitudes of the characteristic waves provide clinically valuable information in the ECG. Arrhythmia is defined as any abnormalities in the wave form and duration of the wave characteristics of the ECG. Using Discrete Wavelet Transform (DWT) analysis, the amplitude and duration of the ECG's characteristic waves may be more precisely determined. Heart Rate Variability is also a good indicator of the cardiac system's non-linear function (HRV). As a result, the ECG signals were subjected to DWT and HRV techniques in order to extract a collection of linear (time and frequency domain) and non-linear characteristic characteristics. The LMT classifier uses these properties as input to categorize 11 distinct arrhythmias. The results show that the current common approaches (DWT and HRV) for cardiac arrhythmia classification have an impressive prediction accuracy of 98 percent, confirming the choice and combined usage of these techniques. After expert confirmation, the system may be deployed for practical usage.

Szi-Wen Chen et.al. [7] they describe a modified version of the sequential probability ratio test (SPRT), which is used to differentiate between ventricular fibrillation (VF) and ventricular tachycardia (VT) in measured surface electrocardiograms. VF stands for ventricular fibrillation, and VT stands for ventricular tachycardia. The method makes use of a unique regularity measure that is applied to threshold crossings from the observed ECG. This measure is given the name blanking variability (BV). The term "blanking variability" refers to the normalized rate of change in heart rate that occurs whenever the blanking interval length is changed. The system was developed and validated using distinct subsets selected from the MIT-BIH database of malignant arrhythmias. The BV values are represented by using a Gaussian distribution that has been truncated, and the parameter values are produced by taking an average across the training portion of the database. The system had an overall classification accuracy of 95 percent when it was put through its paces. M.R. Mhetre1 et.al.[7] has analyzed the Pan Tompkins algorithm has been modified and used. This software can be beneficial to the medical fraternity. An attempt is tried to provide a treatment plan for the more dangerous and frequently occurring arrhythmias.

Heike Leutheuseret.al.[8] Early detection of arrhythmic beats in the electrocardiogram (ECG) signal may help identify individuals at risk of sudden death, such as those suffering from coronary heart disease. We describe a mobile, hierarchical categorization system (three stages in total) that uses entire databases to give real-time analysis in the event of symptoms and, if necessary, a suggestion to attend an emergency department. In this paper, we go over the second stage classifier's training procedure in further depth. After feature selection, the Linear Regression classifier had the lowest false negative rate of 14.06 percent and the highest accuracy of 66.19 percent. It must be determined whether the hierarchical classification system has a higher overall performance in terms of false negative rate or accuracy for the second stage classifier. The whole hierarchical categorization method has the ability to enable automatic, accurate ECG arrhythmia detection that can be readily integrated into everyday life.

According to M. H. Kadbi et al. in [9], those three components for the highlight extraction stage: time recurrence, 2-time space elements, and 3-statical elements. These components have been utilized in their undertaking because these provisions can beat the restrictions of different techniques in arranging various sorts of arrhythmia with high precision immediately. Furthermore, these strategies have been joined with the PCA strategy to diminish the excess brought about by the recurrence coefficient in the element measurement to ensure the normal of the characterization exactness can be expanded.

G.G. Herrero et al. in [10] utilized the free part examination and coordinated with pursuits for the feature extraction for separating extra spatial elements from multichannel electrographic accounts. It tests the order execution of the five most significant classes of heartbeats in the MIT-BIH arrhythmia data set, which are typical sinus thumps (NSB), left pack branch block (LBBB), right group branch block (RBBB), untimely ventricular withdrawal (PVC) and paced pulsate (PB). The presentation of the framework is strikingly acceptable, with specificities and sensitivities for the various classes. However, the modified T wave has an issue because of the chaotic partition between ventricular PBs and PVCs.

A. Ahmadian et al. in [11] proposed a new piecewise demonstration for the estimate of ECG signal utilizing Hermitian Basis. This technique uses just the fifth request Hermitian premise capacities. This technique respects gauging the guess mistake of each portion based on its significance all through the ECG complex. This technique shows that the absolute error in this strategy is close to divided in examination with a comparative non-sectioned approach. The drawback of this strategy is that a bit of a mistake could deceive the analysis.

K.S. Park et al. [12] applied two morphological element extraction strategies: higher request insights and Hermite premise work. Their examination results showed that a progressive characterization strategy gives preferable execution over the regular multiclass arrangement technique. They utilized the help vector machines to think about the component extraction strategies and grouping techniques to assess the speculation execution. In any case, higher

request models need more calculation cost and cause the relevant issue in speculation execution. As far as precision, they found that their various leveled arrangement. The strategy showed preferred grouping execution over the traditional multiclass characterization technique, notwithstanding the misfortune inexactness and sensitivities with a specific class.

Bekir Karhket et al. [13] The P wave, the QRS complex, and the T wave combine to create the electrocardiogram signal. The P wave is produced as a consequence of the QRS complex ventricular contraction, which takes place as a consequence of electrical stimulation beginning at the sinoatrial node and extending across the cardiac muscles. The T wave is produced when the ventricle relaxes as a result of the preceding phase. The time domain analysis is performed on the electrocardiogram data in this study. In order to do this, the relevant mean time intervals of the ECG are utilized for the goal of performing arrhythmia diagnosis as the feature extraction. The elapsed time that occurs between two R waves on an electrocardiogram is referred to as the RR interval.

Chuang-chienet et.al.[14] The ailment known as arrhythmia is one example of a condition that might result in mortality and can be considered an emergency situation. The ventricular premature beat is the most prevalent type of arrhythmia that can occur in the heart. The primary objective of this research is to design an effective arrhythmia identification method that is based on the morphological features of arrhythmias and makes use of the correlation coefficient in an electrocardiogram signal. In the course of the research, normal participants, patients diagnosed with atrial premature contraction (APC), and patients diagnosed with ventricular premature contraction all served as subjects (PVC). The technique developed by So and Chan was utilised in order to pinpoint the sites of QRS complexes. When the QRS complexes were identified, the correlation coefficient and RR interval were applied to do the calculation of how similar the arrhythmias were to one another. The technique was validated by utilizing the MIT-BIH arrhythmia database, and each QRS complex was categorized in the aforementioned resource. The total number of normal beats, APCs, and PVCs was 538, 9, and 24, respectively, out of the total amount of test data. The findings are given with an emphasis on performance, as well as positive prediction and sensitivity. A high overall performance of 99.3 percent was attained for the categorization of the various groups of arrhythmic beats. Positive prediction values obtained from the system reach 99.44 percent, 100 percent, and 95.35 percent, respectively, for normal beats, APCs, and PVCs. The findings of the system's sensitivity test show that it is 99.81 percent accurate for normal beats, 81.82 percent accurate for APCs, and 95.83 percent accurate for PVCs, respectively. According to the findings, the classification method can accurately and effectively determine whether arrhythmias were caused by APC or PVC. As a result, the suggested arrhythmia detection algorithm contributes to the clinical diagnosis in a positive way.

S. C. Saxena et al. [15] has combined modified Wavelet transform tech for Quadratic spline wavelet is used for QRS detection, and Daubechie's six coefficient wavelet used P and T detection and diagnosis of cardiac disease.

Stefan Gradl et al. [16] had This work discusses a modified mixed wavelet transform approach for analyzing multilead ECG data in the context of heart illness diagnosis. For QRS detection, a quadratic spline wavelet (QSWT) was utilised, while for P and T detection, the Daubechies six coefficient (DU6) wavelet was used. The required ECG parameters for illness diagnosis are retrieved when the basic electrocardiogram waves are detected. Extensive testing on the CSE DS-3 database and the MIT/BIH database confirmed the programme. A strategy for diagnosing heart disorders, such as tachycardia, bradycardia, left ventricular hypertrophy, and right ventricular hypertrophy, has been developed utilising ECG data and a point scoring system. Because the CSE group has yet to provide the diagnostic results, two other diagnostic criteria have been employed to verify the test results' diagnostic validity. When both diagnostic criteria yielded the same results, the consistency and reliability of the discovered and measured parameters were validated. J. Lee, K. et.al.[17] has done info include By wavelet change and separate straight examination. This proposed calculation acquired great exactness of arrhythmia detection that NSR, SVR, PVC, and VF was 98.52%, 98.43%, 98.59%, and 98.88% separately.

Khaled Daqrouqand et al. [17] In this research, a novel approach of arrhythmia classification is described, which is based on evaluating the ECG signal and extracting the necessary characteristics associated to arrhythmia using the continuous wavelet transform (CWT) (heart rate variability). Two models are utilized to imitate genuine cardiac signals; these models are used to evaluate ECG signal processing technologies since they have similar features to natural signals. Simulation of cardiac events and disorders such as Normocardia, Bradycardia, and Tachycardia is another use. The suggested approach distinguishes between Normocardia, Bradycardia, and Tachycardia with a crisp, obvious threshold.

S. Karpagachelvi, et.al.[18] ECG Feature Extraction is useful in detecting the majority of heart disorders. The P-QRS-T waves make up one cardiac cycle in an ECG signal. For further analysis, this feature extraction approach calculates the amplitudes and intervals in the ECG signal. The amplitudes and intervals of the P-QRS-T segment affect how well a human's heart works. Numerous studies and strategies for evaluating the ECG signal have recently been created. Fuzzy Logic Methods, Artificial Neural Networks (ANN), Genetic Algorithms (GA), Support Vector Machines (SVM), and other Signal Analysis techniques were largely used in the suggested systems. All of these

strategies and algorithms have their own set of benefits and drawbacks. This proposed article addresses several strategies and modifications for extracting features from an ECG signal that have been described before in the literature. This report also includes a comparison of several approaches for extracting the feature from an ECG signal suggested by researchers.

J.I. Willams et.al.[19] The authors propose a series of guidelines for standardising measurements in quantitative electrocardiography. It is the product of research based on a measurement reference library that was independently analysed by a group of cardiologists and various computer programmes, as well as debates made at multiple CSE Working Party meetings. The nomenclature and definitions defined by several American Heart Association Committees have been revised. A technique for evaluating the findings of wave recognition computer programmes that analyse XYZ or 12-lead ECGs in groups of three concurrently recorded leads has been presented, and guidelines for minimum wave requirements, amplitude, and interval measurement processes have been created.

Pedro R.Gomes et al. [20] Using state-of-the-art Hidden Markov Models, this work presents a comparative evaluation of feature extraction strategies for cardiac arrhythmia classification. Normal (N), premature ventricular contraction (V), which is typically a precursor to ventricular arrhythmia, and two of the most prevalent kinds of supra-ventricular arrhythmia (S), atrial fibrillation (AF), atrial flutter (AFL), and normal rhythm are the types of beats chosen (N). Standard linear segmentation and wavelet-based feature extraction are the approaches examined for feature extraction. The method used to study wavelets was to look at the signal at multiple scales, or different levels of focus, at the same time. Wavelet transform outperforms normal linear segmentation in actual data from the MIT-BIH Arrhythmia Database, according to experimental results.

V.Rathikaraniet.et. al. [21] An automated categorization of cardiac arrhythmias is described in this research utilising a transfer deep learning technique and electrocardiography (ECG) signal processing. In today's world, an ECG waveform is a strong tool for analysing cardiac arrhythmias (irregularities). The purpose of this study is to develop a deep learning-based method for categorising various cardiac arrhythmias. With the use of Continuous Wavelet(CWT), one-dimensional (1-D) ECG signals are first translated into two-dimensional (2-D) scalogram pictures. To test the suggested approach, four distinct types of ECG waveform were chosen from four PhysioNet MIT-BIH databases: arrhythmia database, Normal Sinus Rhythm database, Malignant Ventricular Ectopy database, and BIDMC Congestive heart failure database. The goal of this research is to create a transferable deep learning algorithm for automated classification of the four cardiac illnesses stated above. The 2-D scalogram pictures trained using a deep convolutional neural network CNN with transfer learning approach (AlexNet) pepped up with a notable accuracy of 95.67 percent, according to the final results. As a result, it's worth noting that the algorithm described above works well as an automated method for detecting cardiac problems.

Sarkalehet. et. al. [22] Automatic identification of cardiac arrhythmias is critical for cardiac abnormality diagnosis. Several methods for classifying ECG arrhythmias have been presented, however they do not perform well. As a result, an expert system for electrocardiogram (ECG) arrhythmia categorization is suggested in this study. The ECG recordings are processed using the discrete wavelet transform, and certain characteristics are extracted using the Multi-Layer Perceptron (MLP) neural network. The suggested method can identify two types of arrhythmias. Our neural network-based classifier was trained and tested using recordings from the MIT-BIH arrhythmias database. Using ten files, including two normal and two arrhythmias, simulation results demonstrate that our approach has a classification accuracy of 96.5 percent.

Narendra Kohliet et al. [23] have concentrated on the SVM techniques four calculations One against One (OAO), one against All (OAA), Fuzzy Decision Function (FDF), and Decision Directed Acyclic Graph (DDAG) head part analysis (PCA) strategy. Results are acquired from SVM strategies, four notable and broadly utilized calculations performing Classification of ECG datasets through SVM-based techniques. One Against All (OAA) gives preferable outcomes over order without highlight choice.

Rune Fensli, EinarGunnarsonet.et.al.[24] has dissected the remote and wearable sensor ECG framework, a handheld gadget with RF beneficiary and arrhythmia calculation. The idea for remote and wearable ECG sensors sends a sign to an analytic station at the emergency clinic. It recognizes events of heart arrhythmia once in a while.

Mansi Varshney et al. in [25] This study addresses several strategies for extracting features from an ECG signal that have previously been presented in the literature. In addition, this paper presents a comparison of methods for determining the overall system's correctness. Artificial Neural Networks (ANN) and Support Vector Machines (SVM) were used in the majority of the suggested systems. (SVM), Multilayer Perceptron (MLP), Morphological Descriptor Time-Frequency Distribution (MD-TFD), and other techniques. Techniques for Signal Analysis All of these strategies and algorithms have their own set of benefits and drawbacks.

Wei Liang et al. in [26] A innovative technique to ECG signal filtering and categorization is presented in this research. Unlike existing approaches, which attempt to collect and interpret ECG signals while the patient is still laying in bed in a hospital, our suggested algorithm is specifically designed to monitor and categorise the patient's

ECG signals while the patient is free to move around. Patients are given wearable ambulatory gadgets to wear throughout the day, allowing for real-time heart attack detection. An integral-coefficient-band-stop (ICBS) filter is used in ECG preprocessing to avoid time-consuming floating-point computations. ECG feature extraction and classification are also accomplished using two-layered Hidden Markov Models (HMMs). In the first HMM layer, where expert-annotation aided Baum-Welch method is used in HMM modelling, the periodic ECG waveforms are split into ISO intervals, P subwave, QRS complex, and T subwave, respectively. In the second HMM layer, the matching interval characteristics are picked and used to classify the ECG into normal or pathological type (PVC, APC). We developed an ECG body sensor network (BSN) platform to test the effectiveness of our algorithm on abnormal signal detection. This platform collects, transmits, and displays real-time ECG signals, as well as the corresponding classification outcomes, which are deduced and displayed on the BSN screen.

E. Roland Adams et al. in [27] Cardiac arrhythmias are characterised by abnormal heartbeats. An electrocardiogram can detect these irregularities (ECG). By studying the PQRST wave characteristics, details from this electrical signal may be utilised to categorise what form of arrhythmia the patient has, if any. Bundle Branch Block, Supraventricular Tachycardia, Ventricular Tachycardia, Tachycardia, and Bradycardia were the arrhythmias studied in this study. An artificial neural network (ANN) was used to scan many data samples of typical ECG features and identify the differences between a normal signal and an irregular signal. The information was gathered from the MIT-BIH Supraventricular and Arrhythmia databases. Taking the signal's Fast Fourier Transform (FFT) is a common approach for analysing cardiac arrhythmias. An alternative approach is utilised to predict cardiac arrhythmias in this study. This data is used to create and programme a neural network, which is then evaluated to ensure that the data set is legitimate. The data is then analyzed and predicted using MATLAB's pattern recognition tool. The data set was validated by putting the program's results to the test. On the test data, the ANN was 98.6 percent accurate. This study's findings and outcome probability are more accurate than certain existing techniques of analysis. The medical community and patients will benefit from advancements in the identification of cardiac problems and early detection of debilitating medical disorders when neural networks are employed to evaluate and test medical data samples.

Shiv narayan Patidar et al. In [28] For the identification of heart valve diseases, automated segmentation of cardiac sound waves into heart beat cycles is usually necessary. A novel approach for segmenting cardiac sound data using the tunable-Q wavelet transform (TQWT) is provided in this research. The murmurs from cardiac sound signals are eliminated using TQWT-based decomposition and reconstruction that is appropriately constrained. The TQWT's Q-factor, redundancy parameter, and number of decomposition stages are adjusted to match the statistical features of the murmur-free reconstructed cardiac sound signals. After removing low energy components from the reconstructed cardiac sound signals, the envelope based on cardiac sound characteristic waveform (CSCW) is retrieved. The heart beat cycles are then calculated from the original cardiac sound signals by mapping the requisite CSCW timing information, which is collected using standard procedures. The experimental data are given to demonstrate the efficacy of the suggested approach for segmenting cardiac sound waves in contrast to other current methods in a variety of clinical scenarios.

C. V. Banupriya et al. in [29] The electrocardiogram (ECG) is an important tool for evaluating people who have aberrant cardiac activity. ECG recordings of the patient were acquired to examine abnormalities and diagnose the kind of cardiac dysfunction present. An electrocardiogram (ECG) is a bioelectrical signal that measures the electrical activity of the heart over time. It is used to assess the pace and regularity of heartbeats, as well as the size and position of the chambers, the presence of any heart injury, and the impact of medications or devices used to control the heart. An ECG recording of a patient provides critical clinical information for medical professionals to identify the patient's heart functioning or to assess the patient before to surgery. The interpretation of an ECG signal is a pattern recognition application. Premature Ventricular Contraction (PVC), Atrial Premature Beat (APB), Left Bundle Branch Block (LBBB), Right Bundle Branch Block (RBBB), Paced Beat (PB), and Atrial Escape Beat are examples of cardiac diseases (AEB). Various feature extraction methods and classification algorithms are utilised to evaluate ECG. The intended research used the discrete wavelet transform (DWT) to extract features from ECG data from the MIT-BIH Arrhythmia Database.

Leigang Zhang et al. have [30] For the identification of cardiac abnormalities, automatic analysis of cardiac arrhythmias is critical. The combination of Wavelet transform and Decision tree classification is used in this work to classify ECG data in a unique way. There are two sides to this strategy. In the first aspect, we use the wavelet transform to extract the ECG signals wavelet coefficients as the first features, then we use a combination of principal component analysis (PCA) and independent component analysis (ICA) to remove the first features relativity and search for independence as the new features, and finally we add the RR interval as the final features. The ID3 algorithm, which is one of the analytical decision tree approaches, is used as a classifier to distinguish distinct cardiac arrhythmias in the second aspect. To build and evaluate the categorization, we used the MIT-BIH Arrhythmia Database. The results show that it has a high level of dependability and accuracy.

Mehmet Korük and colleagues in [31] This study offers an electrocardiogram (ECG) beat categorization method based on neural networks and particle swarm optimization (PSO) and radial basis functions (RBFNN). There are six different types of beats in the MIT-BIH arrhythmia database: normal, premature ventricular contraction (PVC), fusion of ventricular and normal beat (F), atrial premature beat (A), right bundle branch block beat (R), and fusion of paced and normal beat (f). Four morphological traits are extracted from each beat after preprocessing the selected records. The classification process of the extracted features is carried out using an RBFNN structure created using particle swarm optimization. On the test set, several experiments are conducted, and it is found that the suggested method accurately detects ECG beats with a smaller network size.

AfseenNaaz et al. in [32] has clarified the programmed examination of the unpredictable capacity of heartbeats and extricating the elements of electrocardiogram signal by applying pre-handling procedure to eliminate commotion, highlight extraction utilizing Pan-Tomkins Algorithm and component grouping by using support vector machine and molecule swarm improvement.

S. Celin et al. have [33] proposed a strategy to describe the electrocardiogram signal as unusual or ordinary by applying distinctive order and elements procedures like straight and non direct strategies. The ECG signal is used to represent the electrical activity of the heart. The distinct peaks P, QRS, T, and U that occur repeatedly at a certain interval of time identify this ECG signal. Peak occurrence can alternatively be described as a PR interval, QRS complex, QT interval, PR segment, and ST segment. These peaks have typical range values for their amplitude and time interval. The heart rate signal becomes abnormal when these values depart from the required levels. The values of the peaks in the ECG signal, which are retrieved as features using mathematical models, are used to classify various disorders. These aberrant signals are specifically portrayed as arrhythmia signals, which pose a serious hazard to people. Arrhythmia refers to a heart rate signal that is aberrant or irregular. The retrieved characteristics will define the nature of each signal and will be utilised in subsequent categorization. This research examines several strategies for extracting and classifying features from both normal and pathological ECG data.

S. T. Sanamdikar et al. In [34] utilized a procedure to investigate the unpredictable capacity of heartbeats and execution of noised Electrocardiogram signs to produce de-noised electrocardiogram signs of P-Q-R-S sections. Arrhythmia analysis of ECG signals is important in detecting the majority of heart disorders. The P-QRS-T waves make up one cardiac cycle in an ECG signal. This suggested study examines several strategies and transformations for extracting features from an arrhythmia analysis and interpretation of ECG signal that have been proposed previously in the literature. In addition, this report offers a comparison of the various methodologies proposed.

Z. Zidelmal et al. is [35] clarified the examination of sporadic capacity and electrocardiogram beat classes from uproarious ECG signals by applying a support vector machine to remove highlights like the R-R segment, Q-R-S complex by its co-proficient. We provide a new approach for ECG beat classification that employs a Support Vector Machines (SVMs) classifier with rejection in this work. The QRS complexes are recognised and segmented during ECG preprocessing. To characterise each beat, a collection of characteristics is used, including frequency information, RR intervals, QRS morphology, and AC power of QRS detail coefficients. The feature vectors are then classified using an SVM. Following the cost of misclassifying a sample and the cost of rejecting a sample, our decision rule employs dynamic reject thresholds. When the suggested technique is evaluated using the MIT-BIH arrhythmia database, it shows a significant improvement in performance. The obtained findings show an average accuracy of 97.2 percent with no rejection and 98.8 percent at the lowest classification cost.

Thomas T. Poels et al. in [36] examined the gathering of patients to distinguish Q-R- S signal in an Electrocardiogram signal by isolating the patient sicknesses. Using electrocardiographic criteria, the Selvester QRS score (S-score) measures myocardial scar. The S-score for the left bundle branch block was calculated (LBBB). There was no link between S-scores pre-TAVI and post-TAVI in TAVI-LBBB patients ($R2 = 0.023$). Patients with low pre-TAVI scores had high S-scores after TAVI. In TAVI-nQRS, there was a slight correlation between pre- and post-TAVI scores ($R2 = 0.182$), indicating that TAVI may have influenced ventricular unloading. S-scores at post-TAVI and follow-up were comparable in both groups ($R2 = 0.389$ and $R2 = 0.386$), showing repeatability in more stable patients.

A. D. Jeyarani and T. Jaya Singh are [37] proposed a pre-handling method to diminish commotion in noised electrocardiogram signal by utilizing Low cut channel, Averaging channel, and band end channel to create the clear sign. This document contains useful information regarding the heart's and cardiovascular system's functional characteristics (CVS). The characteristics recovered in this study by treating the heart signal as a sound signal may aid in the development of improved diagnostic tools for cardiac disorders. The goal of this study is to create computerized cardiac auscultation systems and develop signal analysis methodologies. Using modern signal processing techniques, the research focuses on feature extraction from the phonocardiography (PCG) data.

Abhinav Vishav et al. in [38] — Using multi-channel ECG recordings, we suggested an automated Artificial Neural Network (ANN) based classification method for cardiac arrhythmia in this research. We are primarily

interested in developing high-confidence arrhythmia classification results for use in diagnostic decision support systems in this work. The classification of arrhythmia instances into normal and pathological classifications is done using a neural network model using a back propagation technique. For MIT-BIH arrhythmia, network models are trained and tested. A mixture of arrhythmic and non-arrhythmic data patients was used to train the various structures of ANN. Sensitivity, specificity, classification accuracy, mean squared error (MSE), receiver operating characteristics (ROC), and area under curve are all used to evaluate classification performance (AUC). Our experimental results show a 96.77 percent accuracy on the MIT-BIH database and a 96.21 percent accuracy on a database that includes the NSR database. electrocardiogram signs to get the cardiovascular arrhythmia.

Nasreen Sultana et al. In [39] proposed a multiclass support vector machine (MSVM) displaying a strategy to acquire the ECG highlights like Normal Sinusitis Rhythm (NSR), Premature Ventricular Contraction (PVC), Right Bundle Branch Block (RBBB), Left Bundle Branch Block (LBBB), Tachycardia (TA) and Bradycardia (BR). These provisions were acquired by applying pre- handling procedure LPF and HPF with a QRS recognition utilizing Hilbert change.

Coast Doughlas et al.in [40] portrayed a way to deal with cardiovascular arrhythmia investigation utilizing Hidden Markov Models. This method is grouped by identifying andbreaking down the QRS complex and deciding the R-R intervals to choose the ventricular arrhythmias. The Hidden Markov demonstrating approach joins primary and measurable information on the ECG signal in a solitary parametric model. Thus, the Hidden Markov demonstrating resolves the issue of detecting low amplitude P waves in typical ambulatory ECG recordings.

C. Li et al. in [41] Wavelet transformations (WTs) have been used to construct an algorithm for recognising ECG characteristic spots. The QRS complex can be recognised from excessive P or T waves, noise, baseline drift, and artefacts thanks to WT's multiscale capability. The relationship between the ECG signal's characteristic points and the modulus maximum pairs of its WT's is shown. The detection rate of QRS complexes with this approach is above 99.8% for the MIT/BIH database, and the P and T waves may also be recognised, even with significant baseline drift and noise.

Mahmood abadi et al. [42] because the outcomes showed that the Discrete Wavelet Transform (DWT)- based component extraction method yields predominant execution. C. Li et al. in [49] have done the ECG investigation utilizing WT. This technique can recognize the QRS wave and P, T wave. This procedure additionally can recognize commotion, standard float, and relics. So it can describe the sign data investigation quite well and reasonably to handle time- differing biomedical signs. The WT is likewise equipped for addressing signals in various goals by widening and packing its premise capacities, as clarified by I. Clark in [49].

Franc Jager in [43] fostered another way to deal with highlight extraction, which is Kahunen Lo‟ eve Transform (KLT) which is an attractive and incredible way to deal with the element extraction and shape portrayal process. It has the arrangement if the likelihood densities of the populace of example vectors of an issue area are obscure. The issue with this strategy is, it is excessively delicate to the boisterous example of ECG signal.

As per P. Ranjith et al. [44], which utilized WT to distinguish myocardial ischemia, the WT is acquired using the quadratic spline wavelet. These compare to the recognition of T wave and P wave. Their strategies showed a relatively higher affectability and ostensible positive productivity esteem. It tends to be effectively reached out to distinguish other abnormalities of the ECG signal. However, this strategy likewise has the constraint that calculations required are higher than those needed by different techniques.

As per M. H. Kadbi et al. in [45], those three elements for the extraction stage: time recurrence, 2-time space components, and 3-factual parts. These elements have been utilized in their undertaking because they can conquer the limits of different strategies in grouping various arrhythmias with high precision without a moment's delay. Furthermore, these techniques have been joined with the PCA strategy to lessen the excess brought about by the recurrence coefficient in the element measurement to ensure the normal of the order precision can be expanded.

Haotian Shi et al. [46] have proposed a compound information layer deep structure comprising a CNN-LSTM organization. Four info layers are developed after thinking about two things, i.e., Heartbeat fragments and RR span highlights. Various steps of 2–1–2 are utilized, and the underlying three sources of info are convolved using the multiple stages. The Subsequent yields from the layers of CNN are then joined and taken care of to the LSTM nets. Two completely associated layers are utilized in this, and their subsequent yield is gotten together with the fourth information. The anticipated name is, in the end, the output from the last associated layer.

Kachuee et al. [47] has proposed a strategy utilized for the exact arrangement of pulses into five unique arrhythmias as for the AAMI EC57 standard using profound CNNs. Further, a method is recommended to send all the essential information to the dead myocardial tissue (MI) arrangement task, first obtained on the given undertaking. The recommended strategy is assessed on the PhysioNet MIT-BIH AD and PTB Diagnostics dataset.

Mousavi et al. [48] have proposed a strategy to satisfy the shortcomings of current arrangement techniques by utilizing a robotized heartbeat grouping technique using profound CNNs to succession the models. The recommended

approach is prepared and tried on the well-known MIT-BIH AD, thinking about tolerant and intra-patient ideal models and fundamental standards. (2019)

According to the ANSI- AAMI principles, Pandey et al. [49] have proposed an 11-layer profound CNNs model to order arrhythmia into the standard five classes. The data set utilized here is MIT-BIH AD. In the model, a start to finish structure strategy is intended for grouping and applied without applying commotion evacuation. Along these lines, this strategy decreases the number of arrangements. Surprisingly, the need to distinguish and portion QRS edifices is takeout.

Sannino et al. [50] have proposed an innovative profound learning approach. The deep neural organization classifier utilized here makes all the neuron layers in light of the ReLU initiation work. In healthcare and bioinformatics, classification is a hot issue, especially when it comes to arrhythmia detection. Arrhythmias are anomalies in the pace or rhythm of the heartbeat that can occur at any time during a person's life. A Holter device is typically used to collect long-term ECG data in order to catch these uncommon episodes. As a result, automatically detecting aberrant heartbeats from a vast amount of ECG data is a critical and significant undertaking. In the last two decades, a slew of approaches to the problem of ECG beat categorization have been developed. Deep learning, on the other hand, has grown significantly since the early 2000s and currently achieves state-of-the-art performance in a variety of domains. We present a unique deep learning technique for ECG beat categorization in this research. The studies were carried out using the well-known MIT–BIH Arrhythmia Database, and the results were compared to the scientific literature. The final findings demonstrate that our model is not only more accurate than the current state of the art, but also competitive in terms of sensitivity and specificity.

Detrending, as proposed by Faust et al. [51], In healthcare and bioinformatics, classification is a hot issue, especially when it comes to arrhythmia detection. Arrhythmias are anomalies in the pace or rhythm of the heartbeat that can occur at any time during a person's life. A Holter device is typically used to collect long-term ECG data in order to catch these uncommon episodes. As a result, automatically detecting aberrant heartbeats from a vast amount of ECG data is a critical and significant undertaking. In the last two decades, a slew of approaches to the problem of ECG beat categorization have been developed. Deep learning, on the other hand, has grown significantly since the early 2000s and currently achieves state-of-the-art performance in a variety of domains. We present a unique deep learning technique for ECG beat categorization in this research. The studies were carried out using the well-known MIT–BIH Arrhythmia Database, and the results were compared to the scientific literature. The final findings demonstrate that our model is not only more accurate than the current state of the art, but also competitive in terms of sensitivity and specificity.

Fawaz et al. [52]. Their deep learning for time series classification review discovered that ResNet beats all other evaluated deep learning models TSC (Time Series Classification) is a crucial and difficult topic in data mining. Hundreds of TSC algorithms have been proposed as the availability of time series data has increased. Only a handful of these approaches have explored Deep Neural Networks (DNNs) for this job. This is unexpected because deep learning has seen a lot of success in recent years. With the introduction of innovative deeper designs like as Residual and Convolutional Neural Networks, DNNs have truly changed the area of computer vision. Apart from pictures, DNNs can analyse sequential data such as text and audio to provide state-of-the-art performance in document categorization and speech recognition. We give an empirical analysis of the most recent DNN architectures for TSC in this research, which examines the current state-of-the-art performance of deep learning methods for TSC.

Ivanovic et al. [53] Atrial fibrillation (AF) and atrial flutter (AFL) are atrial arrhythmias that are linked to a higher risk of embolic stroke, making them a priority for cardiologists. Despite the remarkable effectiveness of the published approaches for AF detection, little emphasis has been paid to separating these two arrhythmias. In this paper, we present a deep neural network architecture for extracting features from RR interval sequences that blends convolutional and recurrent neural networks. Long-term ECG data were classified as AF, AFL, or sinus rhythm using the learnt properties (SR). For selecting an architectural design and tweaking model hyperparameters, a 10-fold cross-validation technique was adopted. The accuracy was 88.28 percent, with sensitivities of 93.83 percent, 83.60 percent, and 83.83 percent, respectively, for SR, AF, and AFL. After selecting the best network structure, the model was trained on the whole training set before being tested blindfold, yielding 89.67 percent accuracy and 97.20 percent, 94.20 percent, and 77.78 percent sensitivity for SR, AF, and AFL, respectively. The suggested model's promising results inspire the construction of a highly specific AF and AFL detection approach based on deep learning in the future. The ability to distinguish between these two arrhythmias can improve therapeutic efficiency and reduce the time it takes to return to a normal cardiac rhythm.

J. Lee, et al. [54] they presented 17 wavelet-based input features for arrhythmia identification in this paper, and using linear discriminant analysis, we decreased the feature dimension to four. A multi-layer perceptrons classifier was then used to recognise 6 types of arrhythmia beats using a newly developed 4 dimension input feature. The arrhythmia detection effectiveness with these (LDA) was compared to that with original input features (ORG) and

that with input features using principle component analysis (PCA) for assessment of input features by linear discriminant analysis. When LDA was compared to ORG for different types of arrhythmia beats, the former revealed similar or slightly higher values than the latter, with the exception of SVT. Furthermore, LDA consistently outperformed PCA. The reduction of input feature dimension by linear discriminant analysis was discovered to be previous to that by principle component analysis in these cross-validations for the detection of many types of arrhythmia beats. Even when compared to ORG, LDA maintained an acceptable degree of efficiency, implying that time and computational expenses would be drastically reduced. Finally, using the suggested method, we were able to achieve high accuracy in arrhythmia identification, with 99.52 percent, 99.43 percent, 98.59 percent, and 99.88 percent for NSR, SVT, PVC, and VF, respectively.

Y. Ozal, et al. [55] calculated the RR-interval and correlation coefficient. Electrocardiogram (ECG) signals should be monitored and documented in order to diagnose arrhythmic cardiac abnormalities. Expert cardiologists examine the obtained long-term signal data. The hardware capabilities of some devices, like the Holter monitor, are constrained. Automatic arrhythmic signal detection would be beneficial for increased diagnostic capability. This work offers a fresh strategy as a potential remedy for these problems.

C.C Chaung, et al. [56] Arrhythmia is a type of sickness that can lead to death and is potentially life-threatening. The ventricular premature beat is the most frequent cardiac arrhythmia. The major goal of this research is to create an effective arrhythmia identification system based on the morphology of arrhythmias and the correlation coefficient in the ECG signal. Normal people, patients with atrial premature contraction (APC), and patients with ventricular premature contraction (VPC) were used as test subjects (PVC). The sites of QRS complexes were discovered using So and Chan's method. When QRS complexes were found, the correlation coefficient and RR-interval were utilised to determine how comparable the arrhythmias were. The MIT-BIH arrhythmia database, which categorised each QRS complex, was used to assess the approach. There were 538, 9, and 24 total test data for normal beats, APCs, and PVCs, respectively. One or more of the measures used to describe the results is performance, along with positive prediction and sensitivity. The classification of diverse arrhythmic beat types led to a strong overall performance (99.3%). The system's accuracy in correctly predicting normal beats, APCs, and PVCs is 99.44%, 100%, and 95.35%, respectively. The system's sensitivity results are 99.81 percent, 81.82 percent, and 95.83 percent, respectively, for normal beats, APCs, and PVCs. The efficacy of the method was demonstrated. The technique was shown to be accurate and effective in classifying arrhythmias caused by APC or PVC. As a result, the suggested arrhythmia detection method is beneficial to clinical diagnosis.

M. Koriirek and colleagues [57] This study offers an electrocardiogram (ECG) beat categorization method based on neural networks and particle swarm optimization (PSO) and radial basis functions (RBFNN). There are six different types of beats in the MIT-BIH arrhythmia database: normal, premature ventricular contraction (PVC), fusion of ventricular and normal beat (F), atrial premature beat (A), right bundle branch block beat (R), and fusion of paced and normal beat (f). Four morphological traits are extracted from each beat after pre-processing the selected records. The classification process of the extracted features is carried out using an RBFNN structure created using particle swarm optimization. On the test set, several experiments are conducted, and it is found that the recommended technique accurately detects ECG beats with a smaller network size without

D.A. Coast and others [58] Based on "hidden Markov modelling" (HMM), a method that has been successfully applied to analyse speech waveforms for automatic speech recognition since the mid-1970s, this work proposes a new approach for analysing ECG arrhythmias. Many ventricular arrhythmias can be categorised by identifying and analysing QRS complexes and figuring out R-R intervals. On the other hand, supraventricular arrhythmias typically need the detection of the P wave in addition to the QRS complex. Hidden Markov modelling combines structural and statistical understanding of the ECG signal into a single parametric model. To estimate model parameters using training data, a maximum likelihood re-estimation technique is applied iteratively. Initial findings indicate that by faithfully modelling the complete beat, including the P wave, this approach may provide

CONCLUSION & FUTURE WORK.

The majority of researchers have created systems based on different methodologies and algorithms in the literature. Although the created detecting system's performance is quite encouraging, more testing is necessary. The automatic recognition of ECG waves is crucial for the diagnosis of heart diseases. The accurate and reliable detection of the QRS complex, as well as the T and P waves, are crucial for an automatic ECG analysis system to operate properly, yet most researchers primarily focus on certain diseases. From the reviewed, it is discovered that hybrid methods, i.e. (CNN and RNN) with 3d Wavelet transform, are needed for ECG analysis in feature extraction and classification techniques in order to acquire the best accuracy and classify the ECG. According to the literature review, signals in 8–9 different classes—typically 2-3 classes—are found. Therefore, additional investigation into this kind of research is undoubtedly

worthwhile. The primary goal of research should be to employ the chosen feature extraction and classification algorithms to improve accuracy and broaden the types of heart disease that can be classified.

The literature review explored Symlet-8 signals, which provided superior outcomes with great precision. However, if there is an abnormality, it is further classified based on labelled ECG waves into various types of abnormalities. If it is "Normal," further categorization is not required. By enhancing the information vector of the preparation information, the recommended model can, according to the classification findings, achieve high affectability when classifying ECG beats into different types of arrhythmia.

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Multi-Class Motor Imagery Classification using Convolutional Neural Network

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Abstract. This research presents a novel methodology in an Electroencephalograph (EEG)-based Brain-Computer Interface (BCI) that directly controls external devices using brain signals. In BCI, the motor imagery (MI) signal, representing a specific limb action, is most often utilized. It does not require any direct movement patterns. Integrating MI-EEG signals into BCI is still fraught with difficulties because the patterns obtained for every recording can differ despite having the same movement. This finding used Convolutional Neural Network (CNN) to dissociate the EEG signals into specific sub-band frequencies and Common Spatial patterns (CSP). The classification model was then used to select the CNN for training. The training results were then used to categorize the specified MI-EEG movement patterns. We examined the model utilizing Brain-Computer Interface Competition (BCI) IV dataset 2a. Compared to using only CNN as the classification model, the results of this method showed a validation accuracy of 75.57%, Kappa up to 0.64, and F-Score up to 0.74. It outperforms EEGNet, C2CM, CW-CNN, Deep Feature Fusion CNN, Pooled CSP, and FBCSP.

INTRODUCTION

Deep learning has recently become a popular machine learning technique, resulting in substantial developments in computer vision and speech recognition [1]. The potential of deep neural networks to distinguish complex feature representations from raw data contributes to their learning capability. This has raised the significance of applying deep learning to the advancement of Brain-Computer Interface (BCI) systems among neuro-engineering researchers since it eliminates the necessity for manual feature extraction seen in conventional BCI systems, which requires domain-specific knowledge in the signal [2].

Electroencephalography (EEG) is a noninvasive method of acquiring brain data vastly used in BCI systems. Several studies have found correlations between EEG signals and actual brain activity. Movement is practiced mentally. This frequently causes decreased mu and beta rhythms contralateral to the movement (event-related desynchronization, ERD) [3]. When the motion imagination is completed, the ipsilateral side of the brain experiences an increase in beta rhythm (event-related synchronization, ERS) [4].

For Motor Imagery (MI) classification, traditional BCI employs discriminative features representing ERD/ERS. Filter Bank Common Spatial Pattern (FBCSP) [5] is a cutting-edge BCI classification technique that discovers a set of linear projections (i.e., spatial filtering) to improve the disparity in the variance of multiclass EEG measurements using temporally filtered signals having dissimilar frequency bands. Following that, feature selection and categorization are performed.

Several feature extraction and classification techniques have been employed in contemporary MI-EEG research. In the classification of MI, the Common Spatial Patterns (CSP) and its different versions, such as the Filter-Bank CSP (FBCSP), have made significant progress. On the other hand, deep learning methods do not depend on handcrafted features.

Recently, numerous new deep learning schemes for EEG-based BCI have been proposed [6]. Many of them use convolutional neural networks as their foundation (CNN). [7] Introduce a deep CNN architecture that employs a fusion of temporal and spatial convolution filters for the preliminary convolution-pooling block and three additional convolution-pooling blocks to reduce dimensionalities further before feeding the outcomes to a fully-connected layer.

RELATED WORK

In [8], a bank of filters with an equivalent spatial pattern is used to extract EEG signal characteristics (FBCSP). To exactly replicate the actual data, fewer samples are needed. Each signal's envelope was restored using the Hilbert

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Transform, and the amplitude was used to anticipate the envelope so that the signal could be down-sampled without losing any data. These more minor characteristics are recovered through the use of "Channel-wise CNN" (CW-CNN) and "Channel-wise Convolution with Channel Mixing" (C2CM). After convolution, the fully connected layers in CW-CNN were used to incorporate all channels with temporal data for categorization. To construct a flexible network, signal convolution in C2CM was done separately in time and space. It does, however, have a more significant number of parameters. C2CM is slower than CW-CNN. The CW-CNN's average accuracy is 73.07 percent.

In [9], Donglin Li *et al*. identified common spatial patterns by analyzing distribution discrepancies and frequency space properties. The feature fusion network extracted vital information from each CNN layer's input data and data from all previous levels, taking into account essential attributes from each CNN layer. The fusion network has linked the properties of neighboring and cross layers. As a consequence, information loss during the convolutional process has been lowered, as has the generation of local and global features. This feature fusion network has been trained, and an adaptive approach has been implemented to improve classification accuracy. The validation accuracy achieved for the BCI competition IV 2a dataset was 71%.

In [10] Syed Umar Amin et *al*. used CNN to recover spatial and temporal characteristics from raw EEG data. Multilayer CNN (MCNN) was developed by combining multiple CNN models to gain useful features from CNN and a multilayer perception (MLP) network in order to accomplish more accurate categorization. The cross autoencoder CNN (CCNN) model combined CNN and cross autoencoder for classification and feature extraction. CCNN accuracy was 73.8 percent for the BCI IV 2a dataset.

Kwon *et al*. proposed a method for depicting spectral-spatial features using deep CNNs [11]. With 54 subjects, Lee *et al.* [12] recently assembled one of the broadest databases for three BCI paradigms involving MI. Several subject-independent techniques, concentrating on the MI dataset, have been previously proposed and evaluated. A further group of researchers presented the Convolutional Common Spatial Pattern Network (CCSPNet) [13] using this dataset.

Jeon *et al.* [14] proposed an approach for learning class-pertinent and subject-invariant feature representations. Although the design concept permits using any decoding model as a feature extractor, the authors demonstrated remarkable results using EEGNet and DeepConvNet.

CSP values of EEG signals are considered in this paper because they are best suited for MI classification. We organize data from 22 channels in a 2D map to determine the positional relationship between electrodes. This data is fed into the CNN model, which produces four-class MI categorizations. We propose a novel CNN framework that takes into account channel spatial correlations. To improve accuracy, depthwise separable 2D convolution and dense layers are combined.

MATERIALS AND METHOD

DATASET DESCRIPTION

This study utilized data from the Brain-Computer Interface Competition IV (BCI-IV) dataset 2a [15]. The data was gathered from 9 subjects who performed Motor Imagery tasks involving movement of the left hand (category I), right hand (category II), foot (category III), and tongue (category IV). The EEG signal was recorded using the 10-20 system with 22 Ag/AgCl electrodes and a sampling frequency of 250 Hz. Each subject was recorded in two sessions on separate days. There are 288 trials within every session or 72 trials per category.

PROPOSED CNN MODEL

Convolution Neural Network (CNN), also called ConvNet, has deep feed-forward architecture and an extraordinary ability to generalize better than fully connected networks [16]. CNN is defined as a biologically inspired concept of hierarchical feature detectors in [17]. It can learn highly abstract features and recognize objects rapidly and efficiently [18]. The appeal of using CNN stems from the concept of shared weights, which minimizes the number of parameters that need to be trained, resulting in better generalization [19]. CNN can be trained seamlessly and without overfitting, because there are fewer parameters [20]. Second, the classification stage [21] is combined with the feature extraction stage, and both use the learning process.

EXPERIMENTAL SETUP

The proposed CNN architecture, depicted in Table 1 consists of four convolutional layers and three dense layers followed by softmax activation function. Block 1 is made up of Convolution2D with a Kernel length of 125. Kernel

length is the length of the first layer's temporal convolution. The padding used is the 'same.' Following that, batch normalization is used, preceded by depthwise convolution2D. Here, 'elu' is the activation function utilized. Following this, average pooling is used. We used three dense layers, dense layer 1 being of (512*1) and dense layer 2 being of (256*1). With the output layer producing four classes, Softmax is the activation function utilized.

The raw data from the .npz file is bandpass filtered with ten filters, each having a bandwidth of 4Hz. The recorded EEG samples from the .npz file are first decomposed into multiple spectrum-specific signals. The Common Spatial values obtained from these filters are fed to CNN, which draws the required features along with a 4-class MI classification.

We have used Batch normalization after convolution2d layer. Batch normalization essentially normalizes the data, and normalized data is almost always good before being passed to any layer. It acts as a stabilizer. This is due to the fact that the input to the next layer for a training sample is determined based on the joint operations of all training samples in this batch normed minibatch [22]. It generates consistency in data and it enables the use of higher learning rates. Networks with batch normalization are typically faster than those without batch normalization.

Recently, the depthwise separable convolution networks such as MobileNet [23, 24], ShuffleNet [25, 26], and Xception [24] have been used to address the issue of long training times. A depthwise separable convolution is a type of factorized convolution in which a standard convolution is factored into a depthwise and a pointwise convolution. In MobileNets [23], depthwise convolution applies a single filter to every input channel. The outcomes of the depthwise convolution are combined using a '1X1' convolution by the pointwise convolution. A standard convolution filters and combines inputs in a single step to generate a new set of outputs. This is divided into two layers by the depthwise separable convolution, one for filtering and another for combining. This factorization significantly reduces computation and model size. The standard convolution operation filters feature based on convolutional kernels and combine features to produce a new representation. To significantly reduce the computational cost, the filtration and combination stages can be separated into two phases using depthwise separable convolutions [24].

Depthwise separable convolutions are made up of two layers: depthwise and pointwise. We use depthwise convolutions to apply a single filter to every input channel (input depth). The depthwise layer's outcome is then linearly combined using pointwise convolution, a simple 1X1 convolution. We used batchnorm and ELU nonlinearities in both layers.

TABLE 1. Proposed CNN Model

Layer (type)	Output Shape	Parameters
Input Layer	[(None, 22, 313, 1)]	0
Conv2D	(None, 22, 313, 16)	2000
Batch Normalization	(None, 22, 313, 16)	64
Depthwise Conv2D	(None, 1, 313, 32)	704
Batch Normalization	(None, 1, 313, 32)	128
Activation (ELU)	(None, 1, 313, 32)	0
AveragePooling2D	(None, 1, 156, 32)	0
Dropout	(None, 1, 156, 32)	0
Separable Conv2D	(None, 1, 156, 32)	1280
Batch Normalization	(None, 1, 156, 32)	128
Activation	(None, 1, 156, 32)	0
AveragePooling2D	(None, 1, 78, 32)	0
Dropout	(None, 1, 78, 32)	0
SeparableConv2D	(None, 1, 78, 32)	1536
Batch Normalization	(None, 1, 78, 32)	128
Activation	(None, 1, 78, 32)	0
AveragePooling2D	(None, 1, 19, 32)	0
Dropout	(None, 1, 19, 32)	0
Flatten	(None, 608)	0
Dense	(None, 512)	311808
Dense	(None, 256)	131328
Dense	(None, 4)	1028
Activation (Softmax)	(None, 4)	0
Total Parameters: 450,132		
Trainable Parameters: 449,908		
Non-trainable Parameters: 224		

PERFORMANCE EVALUATION

The purpose of this section is to assess the efficacy of the study's methods. The accuracy value, Kappa and F1-Score value are the parameters used to evaluate the method's performance. The following equation is used to calculate the accuracy value:

Accuracy denotes categorization problem metric that represents the percentage of accurate predictions. We determine it by dividing the total number of predictions by the number of correct predictions.

$$\text{Accuracy} = \frac{\text{Sum of Number of accurate Predictions}}{\text{Total Number of Predictions made}} \quad \text{X } 100 \qquad (1)$$

The following equation yields the Kappa value:

$$k = \frac{Po - Pe}{1 - Pe} \qquad (2)$$

The F-Measure for Imbalanced Classification Accuracy is extensively utilized since it is a single measure used to summarize the model's performance. F-Measure aims to combine precision and recall into a single metric that encompasses both characteristics. Neither precision nor recall, on their own, tells the whole story. We can have excellent precision but poor recall or excellent precision but perfect recall. With the F-measure, you can exhibit both concerns with a single score [24]. After calculating precision and recall for a binary or multiclass classification problem, the two scores can be aggregated to compute the F-Measure.

The conventional F measure is computed as follows:

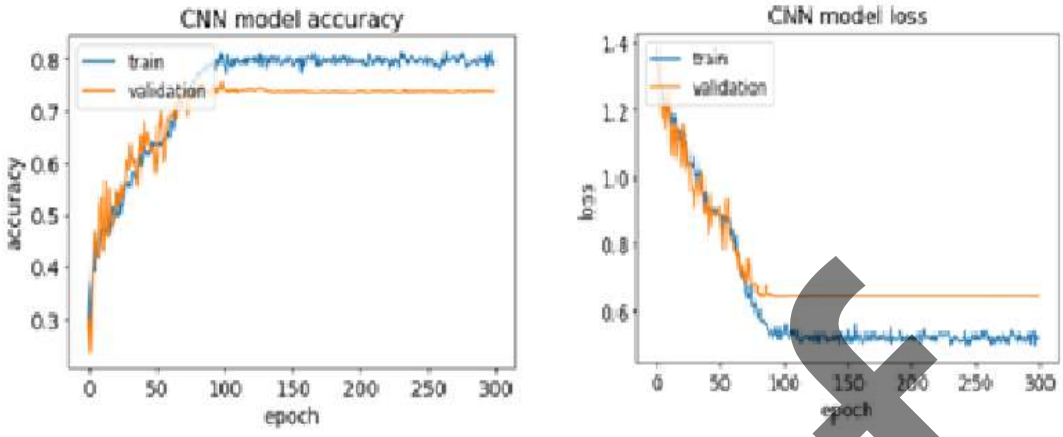
$$\text{F} - \text{Measure} = \frac{(2 * Precision * Recall)}{Precision + Recall} \qquad (3)$$

This is also known as the F-Score and is possibly the most commonly used metric on imbalanced text categorization. When starting to learn from imbalanced data, the F1-measure, which equally weights precision and recall, is indeed the variant most commonly used. After calculating precision and recall for a binary or multiclass problem, the two scores can be combined to determine the F-Measure.

RESULTS AND DISCUSSIONS

We show the Subject Independent (SI) categorization accuracy and loss of the suggested CNN model on the MI-Dataset in Fig.1 (a) and (b). The input signal is sampled at 125Hz. The number of input temporal filters is denoted by F1, and F2 represents the number of pointwise filters. The number of spatial filters to be learned within every temporal convolution is denoted by D.

For the Separable Conv2D layer, we set F2 = F1 * D. The main parameters to pay attention to are F1 and D. The number of time points in the EEG data is represented by the samples = 313. The batch size is set to 32. The minimum number of classes required for classification is four. There are 22 channels in use. The sampling frequency is 125Hz. The dropout rate is 0.45, and the kernel length is 125.



(a) (b)

FIGURE 1. (a) CNN Model Training and Validation Accuracy (b) CNN Model Loss

The validation accuracy graph of our CNN model is shown in Fig. 1. As shown in Table 3, the model's validation accuracy is 75.57%, which is higher than C2CM [8], Deep CNN [11], Deep Feature Fusion CNN [12], and other CNN and EEGNet-based techniques. It shows that our model gives accurate results. Also it gives training loss of 49.4% and Validation loss of 64.18%.

The Confusion Matrix of our CNN model is revealed in Figure 2. The Table 2 gives the Classification Report of the proposed model. Different Classifiers produce multiple categorical outputs. Most error measures in our model calculate the total error, and we cannot find specific incidents of errors. A standard accuracy measure cannot reveal whether the model misclassifies some categories more than others. Furthermore, suppose the data has a significant class imbalance. When a category has more data instances than the other categories, a model may anticipate the majority class for all cases and have a high accuracy score; when it is not predicting the minority classes, a model may have a low accuracy score. Confusion matrices are helpful in this situation. A confusion matrix is a table layout that helps visualize a categorization problem's various predictions and results. It creates a table containing all a classification model's predicted and actual values.

The confusion matrix shown in Figure 2 shows that each class is identified with more than 75% accuracy. We get an F1-Score of 0.74 and a Cohen Kappa Score of 0.64, which shows that the above model is well trained and stable.

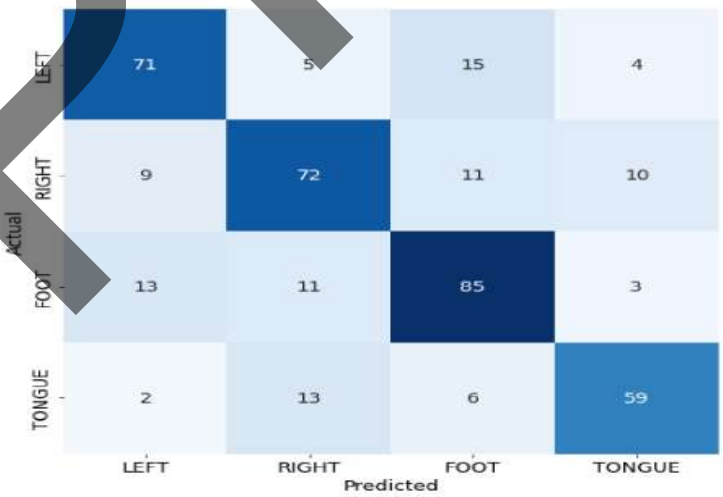


FIGURE 2. Confusion Matrix for our CNN Model

TABLE 2. Classification Report

	Precision	Recall	F1-score	Support
0	0.75	0.75	0.75	95
1	0.71	0.71	0.71	102
2	0.73	0.76	0.74	112
3	0.78	0.74	0.76	80

TABLE 3. The Subject Independent Classification accuracy of various methods on the MI-Dataset

Classifier	Feature Extracted	Data Set	Remark
CW-CNN , C2CM [8]	FBCSP	BCI IV-2A	Accuracy 73.07%
Deep Feature fusion CNN [11]	CSP	BCI IV 2A	Accuracy 71.0%
MCNN CCNN [10]	Spatial and temporal	BCI IV 2a	Accuracy MCNN 75.7% and CCNN 73.8%
Deep CNNs, Pooled CSP[11]	spectral-spatial	BCI IV 2a	Accuracy for Pooled CSP 65.65% For Fused Model is 67.37%
CCSPNet[13]	CSP	54 subjects for three BCI paradigms	Accuracy for CCSPNet 74.11%
Jeon et al. with DeepConvNet [14]	Spatial and temporal	BCI IV 2a	Accuracy 73.32%
Jeon et al. with EEGNet[14]	FBCSP	BCI IV 2a	Accuracy 72.16%
Proposed CNN	CSP	BCI IV 2a	**Accuracy 75.57%**

ANALYSIS BETWEEN THE PROPOSED TECHNIQUE AND OTHER TECHNIQUES

Signal convolution in C2CM [8] was conducted independently in time and space to build a flexible network. However, it has a more significant number of parameters than our suggested technique. The proposed CNN approach is faster than the C2CM method because it requires fewer parameters to be trained. The average accuracy of the C2CM is 73.07 per cent, which is 2.5% lesser than our CNN method. In [11] Deep Feature fusion of CNNs is susceptible to electrode spatial-temporal data misalignment. In the detection phase, high-dimensional features from different modalities generate noise. The simulation findings indicated that our network improved classification performance by 4.5% in the BCI competition IV-2a data set, compared to the Deep Feature Fusion CNNs model accuracy of 71.0%. Another recently published study [13] proposed CCSPNet, a hybrid architecture that combines a wavelet kernel CNN, a temporal CNN, a CSP, and a dense neural network. The new combined architecture attained a LOSO-CV accuracy of 74.11%. Jeon *et al*. presented a deep neural network architecture that learns subject-invariant and class-relevant representations [14]. Using DeepConvNet and EEGNet as feature extractors, the authors achieved the accuracy of 73.32% and 72.16%, respectively. Our proposed CNN method has a higher accuracy of 75.57% than these models.

CONCLUSION

A proposed CNN model was presented to overcome the low spatial resolution of the MI-EEG classification problem. The proposed technique improved spatial resolution by using CSP values from .npz files and information from specific frequency bands. CNN was used to perform the categorization process, which can do so without requiring the selection of specific hand-crafted features. When only CNN was used as the classifier, the results

indicated an increase in average accuracy up to 75.57%, Kappa of 0.64, and F1-Score of 0.74. This algorithm's accuracy and Kappa value were also fairly decent compared to other methods used earlier in BCI competition dataset 2a. Future studies on adaptive algorithms for selecting features for every subject are needed to enhance the current study's proposed approach.

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Coverage Hole Recuperation in Multi-Tier Hierarchical Structure WSN

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Abstract- Wireless Sensor Network consist thousand number of intelligent tiny sensor nodes that form a self-sustainable and self-organising network. These network offers various potential interdisciplinary applications such as in infrastructure development for smart cities, critical health care, precision agriculture etc. Recent technological development has steered up demand of pervasive networks in day-to-day life. However, the fast pace development of wireless sensor network is hampered by few constraints like coverage problem and connectivity issues between nodes that in turn affects network lifetime. Strategic deployments of sensor nodes help in providing some pre-determined number of nodes in ensuring optimal or suboptimal coverage in designated field that also prolong network lifetime. Since maximum coverage with ensured connectivity are two separate issues, however together either they are addressed for finding set of most probable location of nodes or to density of nodes for utmost coverage of event in monitored area. These coverage cavities cause connectivity issues between normal nodes, router nodes and gateway nodes affecting performance of nodes opens interesting research thrusts. Here in this paper an approach has been presented in calculating critical points at boundary of region of interest (ROI) for multi-tier hierarchical network to detect and recovery from coverage cavities and attain long life for network.

INTRODUCTION

Any region in sensor network where a bunch of sensor nodes stops being operational and cannot stay active for handling data propagation is termed as a coverage hole in that network. These coverage holes become roadblock for propagation of gathered information and that area becomes inaccessible to base station/sink in the network [3][4][5]. Once a hole had developed in a region then data would be flown through hole boundary again and again causing undue burden of power drainage on those nodes lying on hole boundary extending no coverage zone in that area. With time size of hole will increase and in turn will reduce performance of nodes and also network lifetime. Efficient and dynamic strategy for node deployment is one of the remedies for coverage hole problem. Deployment of sensor nodes can be both static and mobile in a nature depending upon various factors such as cost of the node, limited battery capability, terrain and other meteorological issues in that network [1]. During operations nodes may fail or their sensing range can also weaken under some sudden uncontrolled scenarios. This may also lead to coverage hole creation. Figure 1, depicts clearly how the holes are developed in a network [6][7]. So formed holes have critical points that are actually the intersection points of two sensor's region which does not fall into the sensing region of any other sensor. Intersection of sensor's region with boundary leads to the formation of Boundary Critical Point (BCP) [13] at the intersection as shown in Figure 1. Here sensing circle S_1 has S_2 and S_9 as neighbouring sensing circles. Sensing circle 'S_1'has intersections P_1,P_2,P_3,P_4,P_5,P_6,P_7 and intersection P_7 is not in transmission range of S_1. This point P_7 becomes critical point b_1 of that sensing circle. Similarly other points are found, joining these points with line segments in clockwise direction till it reaches first point on line. This area bound gives coverage hole, indicated as H_1 in Figure 1. Detection of holes is primary concern to ensure connectivity in sensor network and also to prolong network lifetime. Figure 2 depicts an arrangement for minimum overlap of region of interest for A, B, and C. Here P, Q, and R are intersections of regions also known as critical point. Coverage holes can be classified as closed coverage holes and open coverage holes.

- Closed coverage hole: An enclosed coverage hole made by the critical points only.
- Open Coverage hole: A coverage hole made by the critical points and boundary both.

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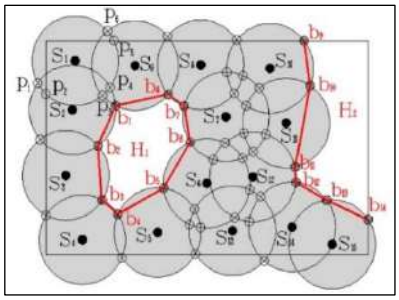


FIGURE 1. Boundary critical points, Intersection points Coverage Hole

Since holes creation happens due to multiple reasons like random deployment of nodes that causes irregular node density in some areas, non-availability of adequate number of nodes in ROI causing improper coverage, environmental conditions seeding impairment of functionality, sudden energy depletion of few nodes deteriorating coverage etc [11][15][17]. Hence for longevity of network accurate detection of holes becomes imperative along with recuperation of them to ensure complete operability of a WSN. This work presents a decentralized approach for discernment and recuperation of coverage hole in multitier hierarchical WSN structure. The approach works in three phases: (I) Critical points on boundary of ROI identified. (II) Set of locations are estimated for nodes in coordinate-free structure. (III) Patching is provided in hole area for connectivity.

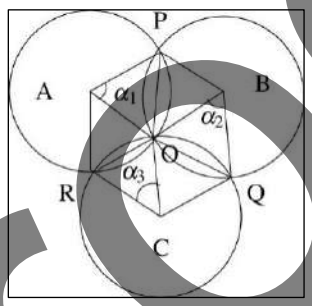


FIGURE 2. Strategy for minimum overlap among sensing regions A, B, C

LITERATUTE SURVEY

Zhao et al. [21] presented a mathematical model for discernment of holes known as Coverage hole detection method (CHDM). In this model sensing range of nodes is chosen half of the estimated transmitting range. A random node 'M' is identified as neighbour of a random node 'N' if it is in transmission range of that node 'N'. Using this central angle among neighbour sensors is estimated from central of circle of node positions refer Figure 2. Once the coverage hole is identified then a patch node or redundant node from circle is moved to unattended area to fill the hole region

Wang et al. [22] presented a boundary disseminated algorithm using repeated flooding of messages in network. Holes are detected using common ancestors. As shown in Figure 2, 'R' is nearest common ancestor of node 'P' and 'Q'. Here a path tree is built rooted at some arbitrary node to calculate shortest path. Also, with cuts in tree the shortest path estimated enclosing composite boundaries of target coverage hole. Network is then inundated with shortest path circle message to find external nodes with maximum local hops to reach common ancestor. Finally, boundary of region of interest of hole is modified without UDG constraint. However, it suffers largely due to huge communication overheads used to sync actions before start of tree formation. Also, presence of multiple adjacent holes causes the algorithm to fail abruptly. Hole detection algorithms are categorised as local detection and global detection based on algorithm. Creation of many holes affect energy levels of neighbouring or adjacent nodes heavily as the region becomes full convex.

Corke et al. [16] had given a novel distributed hole detection algorithm. For local detection of holes initialization of nodes is mandatory to know status of connectivity phase. During initialization phase each node exchanges REQ ping with its neighbour to update latest attributes prior to establish a connection for finding cost effective and shortest

path. Nodes that give positive reply their information is updated in table and also periodically these attributes are updated to maintain integrity in network. However, the nodes that do not reply are assumed as dead nodes in the network. When count of dead nodes goes down of threshold then at this stage damage perimeter is evaluated for ROI. For damage perimeter computation each node estimates overall convex hull by calculating it separately for each node until it stops changing further. It is shared among all neighbouring nodes. As detection of holes is based on path density metric. A distinctive message packet is broadcasted by each node in the network. These packets keep information about source and destination coordinates in ROI, also last coordinates along with hop counts. Here last coordinates of source and destination nodes, hop counts are updated periodically to increase the efficacy of algorithm. Additionally, message Id is used to stop duplicate message transmission saving bandwidth. At end point path density is calculated by taking ratio of shortest path distance to longest path distance. Low ratio indicates presence of holes in network.

Li et al. [23] presented a novel hole detection algorithm based on triangular mesh disk. This algorithm is coordinate free and distributed in nature. This algorithm assumes that sensing range is twice of transmission range of a node. Connectivity information is updated by each active node about its neighbour. For addressing global issues connectivity information of further away nodes are also calculated. However, for large distance space complexity and time complexity of algorithm is also increased which is not appreciated for many applications. Babaie and Pirahesh [25] also proposed a triangular oriented diagram-based algorithm to detect a hole. In it the centres of three adjacent nodes are connected to form a triangular disk shape and then area with full connectivity is calculated. The uncovered area is termed as coverage hole. This coverage hole is patched by implanting a mobile node at centre or at circumcentre whichever is beneficial depending on sensing area. This approach is more like Voronoi diagram structure. In it the hole area is identified efficiently compared to another existing algorithms.

Chu and Ssu [14] presented a decentralized approach based on topological structure for detection of nodes at hole boundary. Each node looks out for its maximum three hop away neighbour by transmitting HELLO message via one-hop and two-hop neighbours in network. Graphs are constructed for two-hop neighbour. If algorithm ends in any such graph, then a hole exists there. Also holes presence beyond two hop is find by another rule of broken contour line on network boundary. Using this method small hole are also detected at boundaries of ROI. There are very few algorithms that can detect boundaries. Dong et al. [14] had given an algorithm that can precisely detect small holes in the network. In it the graph connectivity is reduced by applying vertex deletion and edge deletion. Each cycle terminates as a hole of graph or boundary of ROI. These coarse boundaries are then refined to reach grained boundaries without the knowledge of node density.

PROPOSED SYSTEM MODEL AND METHODOLOGY

1. System Model assumption

In this work we have made some assumptions for system modelling:

- All nodes are randomly distributed in a 2-D space of (X*Y) dimension.
- Sink and all nodes are static in nature. Single Sink is considered.
- Network has homogenous profile i.e., all node carries same energy, having same software and hardware configurations.
- Initial energy, sensing and transmitting range of nodes are same.
- Single hop and multi hop transmissions are used for data propagation
- Network in divided into multiple tiers for disseminated data transmission to ensure prolong lifetime.

2. Proposed Method

A hierarchical structured WSN network is considered here for proposed method that comprises 'n' number of nodes. Entire network area is divided into multiple tiers (ranging from L_1 to L_M, where 1…M are positive integers) following the hierarchical structure [10] [12]. This multi-tier hierarchical structure saves a lot of energy during long distance transmissions. Transmission energy is estimated at each tier separately prior to critical points identification at boundary of ROI using equation (4). Here count of clusters formed in network is 'k', each cluster comprises '$\frac{n}{k}$, member nodes as each node has equal energy, head set members are 'm', so effective member nodes in a cluster is '$\frac{n}{k} - m$'. Energy consumed by electronic circuit in processing 'l- bits' is given as 'E_e' while 'E_s' energy used in sensing and 'E_{DA}' is energy used for data aggregation. Separation in transmitter and receiver is assumed to be 'd'

defined by Euclidean distance between any two points X (x_1, x_2) and Y (y_1, y_2) given in equation (5), also field shape is square [12]. First order radio communication as depicted in Figure 3, is considered for modelling.

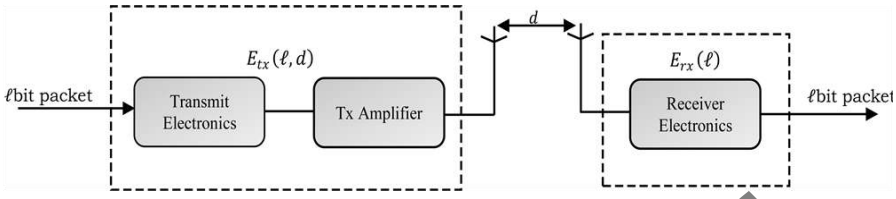


FIGURE 3. First order radio Communication model

Energy consumed for long distance transmission of l – bits is 'E_T', when $d > d_{th}$; is estimated by equation (1). 'E_l' gives energy component used for making long distance communications.

$$E_T(l,d) = l * E_e(l) + E_l(l,d) * d^4 \quad (1)$$

And for short distance transmission when $d < d_{th}$; is calculated by equation (2). Where 'E_s' is energy consumed for propagating at short distance.

$$E_T(l,d) = l * E_e(l) + E_s(l,d) * d^2 \quad (2)$$

In estimation of 'E_{Total}' inter-cluster and intra-cluster communication are considered. Threshold distance is calculated using following equation (3). Since the work is done for homogenous network, it becomes evident for modelling to find accurate set of locations of nodes involved in communication to save energy and calculating critical points on boundaries of ROI.

$$d_{th} = \sqrt{\frac{\varepsilon_{fs}}{\varepsilon_{mp}}} \quad (3)$$

$$E_{Total} = \left(\frac{k}{L}\right) * l * \{L * \left(2 * \frac{n}{k} - m + 2L\right) * E_e - \sum_{j=1}^{L}\left((2j-1) * E_e\right) + L * \frac{n}{k} - m * E_s * d^2 + L * \left(\frac{n}{k} - m + 1\right) * E_{DA} + L * d^4 * E_l + E_l \sum_{j=1}^{L-1}\left(\frac{d_{j+1}}{L-1}\right) * (L-j)^4\} \quad (4)$$

$$d = \sqrt{(y_2 - x_2)^2 + (y_1 - x_1)^2} \quad (5)$$

Critical points are being calculated on boundary of region using BCP algorithm [13]. Pseudo for model as follows:

Step 1: A node 'N' chooses its most likely neighbours based on received signal strength (RSSI). Updates matrix list for neighbours in sensing range.
Step 2: Intersection points (p_i) are recorded with all neighbouring ROIs of node 'N' (refer Figure 2)
Step 3: Critical points (b_i) are selected on boundary; Perform for every node in network. All critical points are connected to detect coverage hole in clockwise direction.
Step 4: Calculate Euclidian distance (d_i) for any two critical points (b_i) and (b_j) using equation (5).
Step 5: when $d_i < 2R$ then a bisector (perpendicular to line $|b_i, b_j|$, R is radius of sensing circle) calculated for that line using $|N_0, b_k| \leqslant R_0$, where i<k<j and R_0 is chosen instead of R using $(R_0 = R - \sigma)$,here σ is small value.
Step 6: In hole area implant new node (patch) at position N.

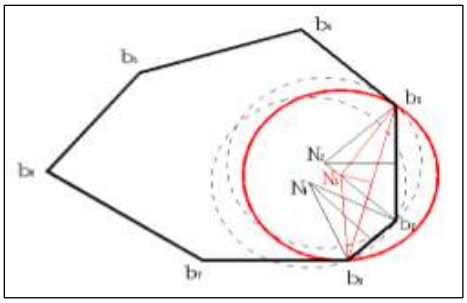


FIGURE 4. Bisector N_1, N_2, N_3 on line (b_1, b_2) and $(b_2, b_3)$for removal of redundant critical point

A matrix called "info" is created that contained all the information about critical points being formed in each iteration. Functions named as "Open Coverage Holes" and "Closed Coverage Holes" are formulated that will give respective areas. In open coverage holes and closed coverage hole all isolated nodes are found through their boundary critical point will form coverage hole based on circle geometry shown in figure 4. Removal of redundant nodes is essential before implanting new patch node. If distance between two node is less than twice of the radius of sensing region then a patch node is implanted between them for full connectivity. It is kept repeating until the node that has a distance greater than two times of radius from first node will be considered redundant. Finally, after patching the hole area every node is assigned its centre as (x_c, y_c) that will give the centre of the node to be patched when it will get starting patched node and next patched node. All patching nodes are placed along a chord by using bisector method as shown in Figure 4. However, infinite circles can pass through a chord and for one particular radius only two can pass. The centre of whichever calculated circle would be nearer to critical point will yield maximum coverage area.

PERFORMANCE EVALUTION

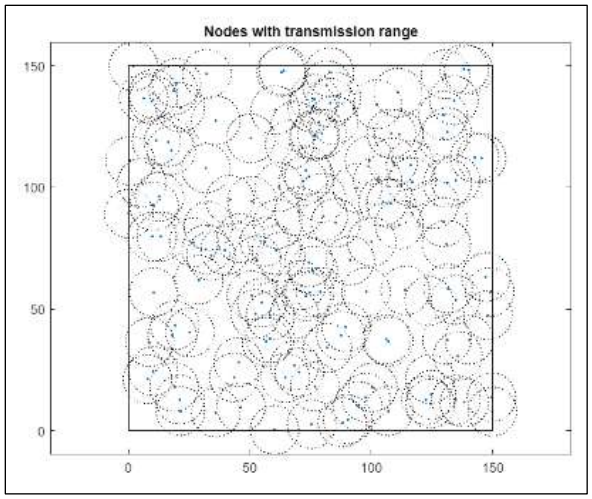
1. Simulation Setup

TABLE 1. Simulation parameter

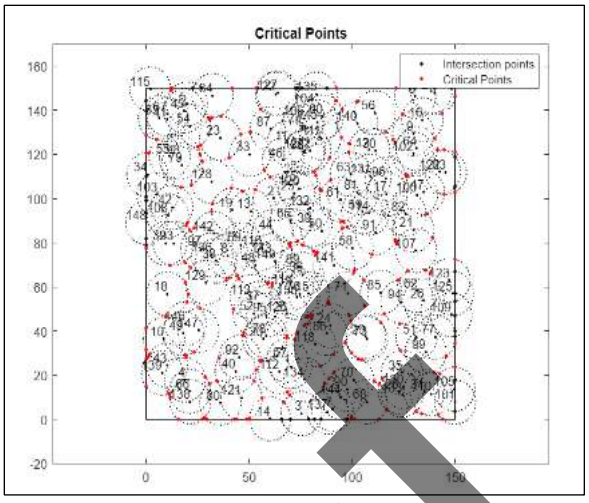
Parameter	Value(s)
Area dimension X*Y (In meters)	150×150
Number of Sensor Nodes	50-150
E_e, Energy consumed in the electronics circuit	50 nJ/bit
l, Total bits in a message	4200 bits
ε_{fs}, Parameter for free space model	10 nJ/bit/m^2
ε_{mp}, Parameter for multipath model	0.0013 pJ/bit/m^4
E_{DA}, Energy used in data aggregation	5 nJ/bit/signal
Transmission range	10 m
Threshold distance	87 m

Simulation is performed on MATLAB 9.4. The simulation parameters are mentioned in Table 1. Model analysed for five different density of nodes with square shape. Using ε_{fs} and ε_{mp} threshold distance is calculated as 87 m with initial node energy 2 J. Packet size is 525 bytes with data flow at CBR (Constant bit rate). For 10 m transmission range sensing circles of 10 m radius are seen in simulation results, Figure 5. (a). These transmission regions for nodes develop intersection with their immediate neighbours at one hop distance; illustrated in Figure 5. (b). Joining any two points with a line coverage hole areas are identified as open and closed holes. All points are joined by lines in clockwise direction till it terminates on same starting point. As all nodes are assumed to be static in nature along with base station so base station location in this square field are chosen at (0,0), (50,75), (85,50), (65,50), and (125,100). Figure 5. (a)-(h) illustrate simulation results for sensor field dimension 150 m* 150 m.

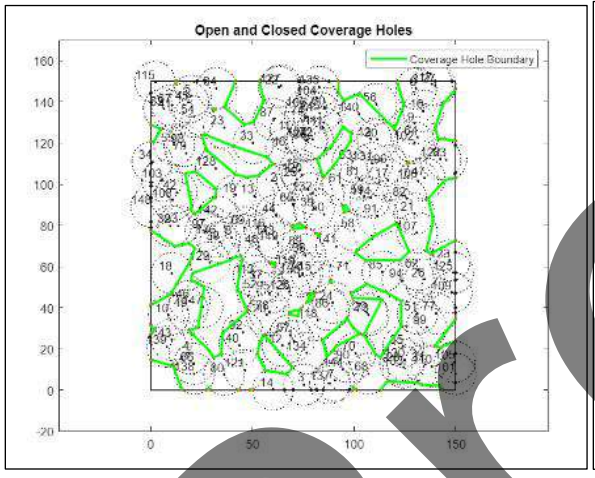
2. Simulation Results



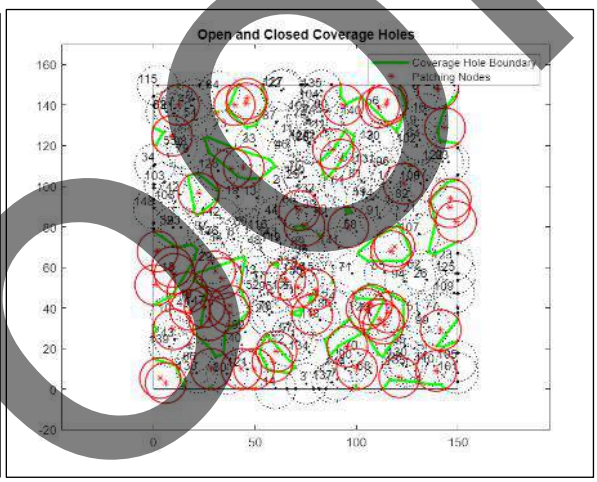
(a): Nodes with transmission range 150m*150m



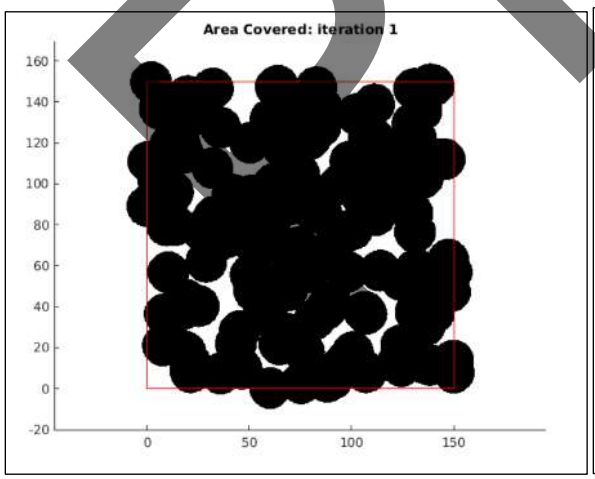
(**b)**: Critical points Identified in 150m*150m area



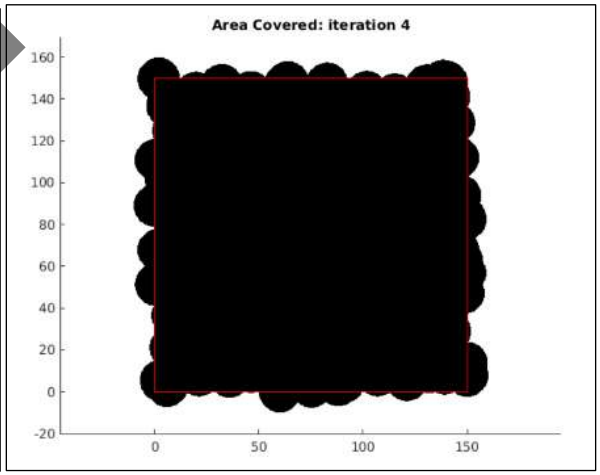
(c): Open /Closed Coverage Holes



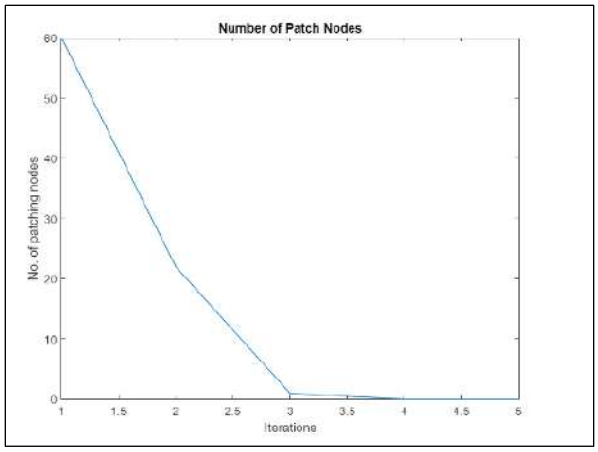
(d): Coverage holes with patching nodes



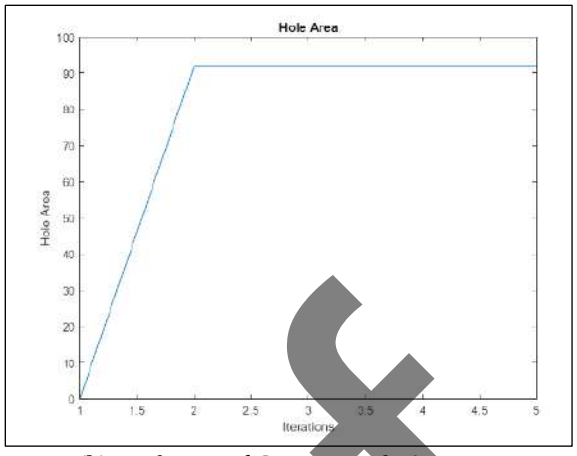
(e): Area Covered in Iteration 1



(f): Area covered after Iteration 4



(g): Patch nodes vs Iteration



(h): Evaluation of Coverage Hole Area

FIGURE 5. (a)-(h) depicts critical points, Coverage holes and patch nodes for a field 150m*150m

TABLE 2. Comparison of Performance Metrics for different size of Network area.

S. No.	Area of region, in meter (unit square)	No. of nodes deployed	No. of nodes Patched	Hole area covered (percentage)	Recovery degree (%)
1.	150X150	50	4	95	2.833
2.	150X150	75	8	100	7.876
3.	150X150	100	28	100	25.985
4.	150X150	125	52	90	31.113
5.	150X150	150	81	90	39.678

As every node in the network calculates intersection points on its boundary from all one hop neighbours around it. So, intersections of a region actually are coordinate free and approach is distributed in nature. Also, if nodes and sink coordinates are known patching becomes more accurate, reduces algorithm complexity. However, algorithm complexity is dependent on many other factors like size of node, power associated with nodes, node density and size of holes etc. Experiment data collected for different sizes of network are shown in Table 2. As the deployment field size is increasing number of patch node required are also increasing for 100 nodes deployment. Coverage hole is covered 100% in fourth iteration as shown in Figure 5(h). For 50 nodes 2.833 % is covered area and for 150 nodes it is 39.678%. With rising density coverage is increasing and network is becoming connected ensuring longevity of muti tier network.

CONCLUSION

Accurate detection and restoration of coverage holes helps in achieving decisive routing protocol for a multi-tier hierarchical WSN network using this method. This solution works well for homogenous network however for heterogenous type of network it has not being modelled yet. Coverage hole patching method was increases performance by evaluating critical points on boundary of ROI in order to keep hole area fully operational in network. It has been ensured that each node try to estimate critical boundary points from inception of transmission that is at single hop only. This increases sustainability of algorithm in later stages of cycle of data gathering. As algorithm works on a coordinate free approach so topological factors also have less impact on it. However, algorithm time complexity increases with rise in node density. Since with increase in field area count of nodes also have to increase in order to get full connectivity in network with less chances for new holes development. Hence this indicates that algorithm does not support scalability adequately. As effective area of ROI and number of nodes deployed is not

related linearly so total area formed by coverage holes will be aggregate of all. Based on this observation a smaller number of nodes are used to calculate effective coverage hole area. In future extension of work model will be analyzed for heterogenous network configuration.

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A novel energy efficient Load Balanced Cluster Assignment algorithm for IoT based sensor network

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Abstract. Load balanced cluster formation in IoT based wireless sensor networks being reported in recent research literature as a well studied NP-hard problem has no trivial or obvious solution. Several protocols proposed in recent studies to resolve the load balancing problem mostly resort to communication intensive centralized algorithms or computation intensive memetic or evolutionary algorithms, that pose significant challenge on their applicability in pragmatic network deployment in real application scenario. This paper presents a simple yet effective distributed greedy algorithm for Energy efficient load balanced cluster assignment (EELBCA) for IoT based large scale sensor network. Our algorithm works in completely localized manner without the need of global topological information about the network. With simple and need based limited message passing the nodes self organize themselves to form well balanced clustered network solely based on their neighborhood information without the need of any computational intensive procedure. We evaluated our algorithm for various deployments viz. Random, Grid based and Gaussian networks and found our work seamlessly works on all such deployments. Simulation results shows our algorithm not only significantly minimizes on the standard deviation of loads among different cluster heads by 20-40% but also minimizes the energy requirement by 70-90% as compared to well documented existing algorithms for different network scenario and different node distribution in the network.

INTRODUCTION

With the unprecedented increase in Internet of Things (IoT) applications, the scalability and load balancing issues in Wireless sensor Networks (WSN) which works as the enabling perception layer for IoT networks becomes a mater of increasing interest for the research community[1]. A wireless sensor network consists of computation and communication elements which helps to observe various events in their environment of deployment[2]. WSN's are known to work on restricted battery power and having restricted transmission range, that is why it necessary to have an energy efficient method to transmit data from the network's sensor nodes to the base station. This energy-efficient transmission thus helps in increasing the network lifetime. Also in WSN, as hundreds of nodes are deployed over an area of interest to sense the environment and subsequent reporting, clustering became a viable approach to deal with limited energy & computation resources of the nodes[3]. In a cluster based communication framework often in each round one or node becomes the cluster head (CH) who in turn collects the data packets from each cluster member (CM) nodes within the cluster, then aggregates and transmit the data packet to either to a distance base station (BS) or to a next hop node on the path towards the BS. Naturally energy usage by the CH nodes in each round is substantially larger than the member nodes in that round of network operation. To mitigate this unbalanced energy usage, role of the CH is often distributed over multiple nodes in the cluster, such that each node discharges its duty in forwarding the data packets to the base station in turns on behalf of the other nodes. Although such role rotation scheme evenly tries to distribute the CH operation among different nodes in different rounds of network operations, it does not guaranties that within a particular round of network operation the number of member nodes serviced by a particular CH is uniform among all the current selected CHs in a particular round. This gives rise to non uniform load balanced clustering problem which, if not mitigated while forming the cluster may summed up over various rounds causing highly skewed energy distribution among the nodes, which in turn lead to serious problems of coverage holes and network partitioning[4].

In [5] authors has shown that problem of unbalance cluster formation is indeed NP-hard, with no trivial or obvious solution. Nodes can communicate among them-selves via wireless connections. Nodes that lie in close vicinity of each other can be group together in a logical way by forming clusters. Each cluster have a coordinator which is responsible for sending data to the base station after collecting it from nodes in the network. This coordinator is called the Cluster

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Head. There are various algorithms which emphasizes on different ways a cluster head could be chosen. Some of these approaches give preference to certain kind of sensor nodes to serve as cluster head. Due to this factor, the responsibility of communicating data comes on these node and this results into drastic energy depletion of these nodes. This may result into the dropping or loosening of such nodes out of the network . Therefore, to reduce the responsibility on a particular sensor node and to distribute the workload throughout the network, load balancing is done. Load Balancing gives an equal opportunity to all the nodes in the network to behave as a cluster head.

Several interesting research works on load balanced clustering in reported in literature in last two decades for different categories of wired and wireless networks, adhoc networks and Mobile adhoc networks (MANETs)[4-10]. However due to intrinsic resource constrained characteristics of the WSNs such algorithms are not readily applicable to Wireless sensor networks. Various recent research works on load balancing specific to sensor networks also have shown that the lifetime of a cluster head is more when load balancing is used in the network. However most of these load balanced clustering protocols resort to centralized algorithms where BS station dictates the cluster formation that caters to load balancing needs[14-18]. Again, load balanced clustering in sensor network is being an NP-hard problem, recently several other protocols reported in the literature that resort to computation intensive heuristics, memetic algorithms or evolutionary algorithms[19-24]. The above algorithms though results in well balanced clustering but their considerable overhead in terms of communication and computational requirements pose a significant challenge on their applicability in real world deployment of such networks.

This work presents a localized greedy algorithm that use nodes neighborhood in-formation to perform load-balancing and clustering. This will result into a stable and energy efficient network as the data communication responsibility would be distributed among the available nodes in the network, which will further increase the net-work longevity for different node deployment patterns and network scenarios.

The paper is organized as follows. In the following sections we present the related works reported in the literature following by the formal problem definition. In subsequent sections we present our algorithm following by performance evaluation and conclusion.

RELATED WORK

Clustering and load balancing have been a well studied research problems in last two decades and various interesting load balanced clustering algorithms proposed in literature for WSNs. Many studies have been done to analyze the existing routing techniques and algorithms from the load balancing perspectives over different network organization and application scenarios.

In [4] authors proposed LBC algorithm where all sensors and cluster heads knows their relative locations, with GPS technique or through pre-configuration. Every cluster head runs the LBC algorithm. The critical distance of the CH is gradually updated to median of distances after being initially set to minimal distance between every node and their corresponding CH. To reduce the cardinality (load) variance among the CHs, member nodes are attached to cluster chiefs.

In [9] Node Local Density Load Balancing (NLDLB) has been proposed. Each CH in this approach have pre-assigned fixed range, and any node that are within this range from a single CH are made members to that cluster. If a sensor node is within R/2 of a CH, even if it is in the range of multiple CHs, it will be allocated to that CH. The clusters with the fewest members in their range are subsequently as-signed to all other sensor nodes.

The authors have presented NGA in [7]. Because genetic algorithms are non-deterministic, using them has several drawbacks. Because of this, every time this algorithm is used, a different set of results for the exact same input are generated. This is because they begin with a random population, and the genetic operators used determine the outcome. Genetic algorithms consequently suffer from the significant drawback of convergent to localised rather than global optimum.

LEACH approach [3] is a well-known method for load-balanced WSN clustering. CHs are selected at random from among the nodes in the network; where all nodes are homogeneous with equal capabilities. This method involves often switching the CHs, which aids load balancing as employing the same node as CHs repeatedly would quickly exhaust the power of those sensor node that CH sensors. Because each sensor node has an equal probability of being chosen, nodes having lower energy die out earlier than the other nodes.

The LEACH algorithm has seen numerous improvements through time[11], and one such enhancement is put out in [6]. To address LEACH's shortcomings, one such improvement is I-LEACH or improved leach. Instead of picking them at random, the CH selection process takes into account the distance of the nodes from other nodes and remaining energy to limit the likelihood of overloading.

The authors of [10] have suggested the implementation of the Load Balancing algorithm based on a Score. Based on ratio between the distance from CH and remaining energy, each sensor node is awarded a score. The sensor node scores more favorably the smaller the ratio. The cluster's two top nodes are used to communicate CH for the remainder of the nodes in cluster. The sensor node with the greatest energy level in any cluster is the CH.

An algorithm for distributed load balancing clusters (DLBCA) is suggested by the authors of [12]. The nodes can choose their role independently to become cluster head or normal member nodes. Cluster heads are chosen independently based on the residual energy of the individual nodes and their proximity information without involvement of global network information. With defining three matrices viz. DD, Flag and FlagDis, DLBCA assigns member nodes to the cluster head in a balanced manner.

Authors in [13] proposed a location independent technique to cluster the network into well defined balanced cluster. With usage of RSSI instead of relying on GPS modules they strive to minimize the energy loss for localization, while otherwise they simply resort to remaining energy and neighbors of a particular node to account for its eligibility to become CH while the member nodes are assigned subsequently based on proximity to the cluster heads estimated using RSSI.

In [18] authors proposed C-DBT-CHR, a centralized approch to form balanced cluster based on node density. The CH role is distributed among nodes in the the cluster following a threshold based CH replacement strategy.

In [16] authors proposed K-Means clustering technique that uses centralized algorithm to cluster the network. The sink node with global information of the network selects set of k best cluster center. Various heuristic techniques like GA, PSO are some of the excellent choice of such centralized algorithms.

A load-balanced genetic algorithm based clustering approach GALBCA is presented in [8]. In their protocol normal sensors used in this clustering process are all encoded into a single chromosome, and each node's gene is set via a randomly chosen legal gate-way node.

In [29] a MAC layer messaging scheme is proposed whereby the nodes are ordered based on their remaining energy quoted in the messages. Nodes having higher remaining energy have more chances to become the CH.

Authors in [28] have developed a subclass of candidate CHs they term VH. Deputy Cluster Head The CH in a cluster is determined by which node has the highest remaining energy. The VH is selected as nodes having second-highest remaining energy since it backs up the CH and is always drowsy. When the CH's residual energy reaches a certain level, the VH awakened and takes its place.

The authors in [30] created a multi-level heterogeneity scheme for energy efficient clustering. They structured the deployment region in to rectangular units of different sizes. Then the number of clusters required for each such unit is computed so that the energy consumption can be balanced among the cluster heads. The optimal number of rectangular component units can then be established by lowering overall energy usage.

Almost all the above algorithms though results in well balanced clustering but their considerable overhead in terms of communication and computational requirements pose a significant challenge on their scalability as well as applicability in real world deployment of resource constraint wireless sensor networks.

EELBCA : ENERGY EFFICIENT LOAD BALANCED CLUSTER ASSIGNMENT

We propose a simple and greedy strategy for Cluster Head assignment. Let us first describe all the assumptions that has been made for the WSN system under consideration. We assume that we have two kinds of nodes in our environment, sensor nodes and the coordinator nodes or cluster heads. The data transfer between the cluster head and the sensor nodes and takes place through wireless links which is established only when the two nodes are falls into each other’s communication range. We assume that the locations of these nodes are known through GPS. We iteratively find the cluster heads which falls in the transmission range of each sensor and assign the sensor to the cluster head which is catering to the minimum sensors at that time.

We start the algorithm by initializing the variables dist and points_con to a Large system value. Here dist is used to indicate the minimum distance between the sensor node under consideration and the cluster head to which it is currently assigned and points_con refers to the maximum connected sensor nodes to a cluster head that falls in the range of the current sensor. Whenever we find a cluster head that falls in the range of the current sensor and having sensors connected to it lesser than points_con, we attach the current sensor to that cluster head. If the number of sensors connected to that cluster head is same as points_con, then we attach the current sensor to this cluster head only if the path_dist, i.e. the Euclidean distance between the current sensor and cluster head is less than dist. At last, we

increase the Assigned value of the cluster head to which the current sensor is assigned. The complete algorithm for EELBCA is described in Algorithm 1

ALGORITHM 1: Energy Efficient Load Balanced Cluster Assignment (EELBCA)

Input: (i) Vector with the coordinates of the nodes, V1={(x1, y1), (x2, y2),.....(xN,yN)}
(ii)Vector with coordinates of the prospective CHs, V2= {(a1, b1), (a2, b2), ...(aM,aM)}
(iii) List of allowable communication range of nodes, Range={r1,r2,r3}
(iv) List of the members sensor nodes already assigned to a cluster, Assigned={s1,s2,.....,sN)

Output: Id's of the CH to which the nodes are assigned, Clusters: c1,c2..,cN

```
procedure ASSIGNHEAD (V1, V2, Range, Assigned)
    for each node i in V1 do
        Clusters[i] ← -1
    for each node i in V1 do
        dist ←   L /*large system value*/
        points_con ←    L
    for each head j in V2 do
        (a,b) ←  V2[j]
        (x,y) ←  V1[i]
        dist ←sqrt ((x-a)*(x-a)+(x-b)*(x-b))
        if dist <= Range[i] then
            if Assigned[j] < points_con then
                points_con = Assigned[i]
                Clusters[i]=j
            else if Assigned[j] = = points_con then
                points_con = Assigned[i]
                Clusters[i]=j
                Assigned[clusters[i]]++
            return Clusters[]
```

PERFORMANCE EVALUATION

To evaluate the performance of our algorithm we simulated some recently reported interesting load balancing protocols viz. LBC[4], EELBC[20], DLBCA [12], LLLBC[12] under similar network condition in Matlab simulink software. To under-stand applicability of our algorithm and evaluate standard deviation among cluster head nodes, we simulated different network deployments with various probability distribution functions viz. Normal random distribution, Gaussian distribution and grid based networks. To simulate different network scenario, we have distributed 50,100 and 150 nodes each distributed for different network dimensions of network size 50x50, 100x100, 150x150 units following each of the above node distribution functions. To evaluate the energy efficiency, we run the simulations until the first node dies (FND), and Last node dies (LND) and calculated the average energy consumption by the nodes.

Fig. 1 and Fig. 2 shows the standard deviation for different networks with Normal random node distribution functions and grid based networks. As seen our algorithm effectively minimizes the standard deviation in cluster head load in all types of networks. Also the deviation in cluster load is far less when compared to other algorithm, because

our algorithm explicitly keeps a check on the number of members joining the cluster head while formation of the cluster.

Fig 3, and 4 shows the average energy consumption by the nodes at different rounds of network operation. As it is seen in all cases our algorithm out performs the existing protocols as far as energy consumption is concerned. This is be-cause our protocol solely use simple assignment with minimal localized messaging overhead for load balanced cluster assignment.

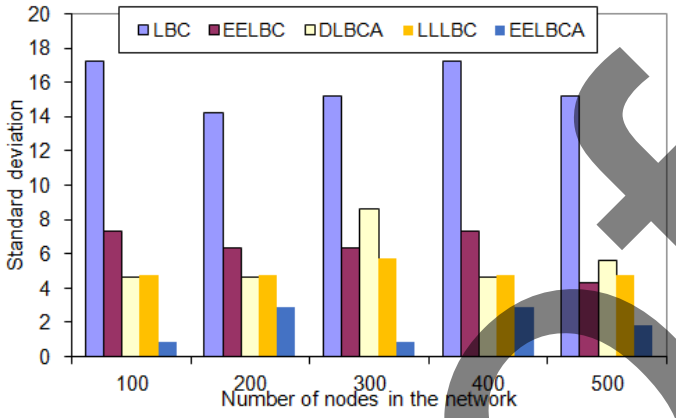

Figure 1. Standard deviation for network with normal distribution of nodes

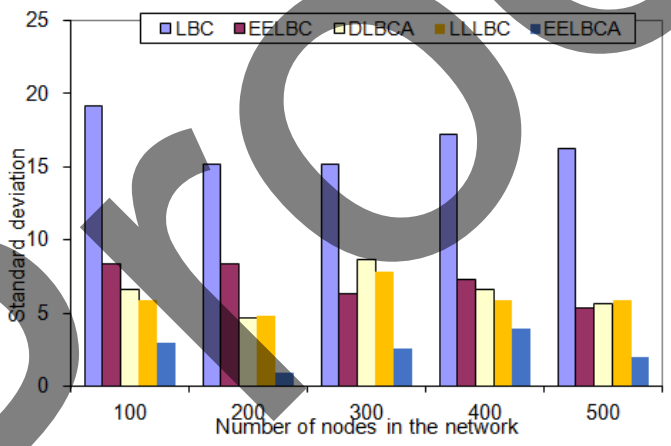

Figure 2. Standard deviation for network with Grid based network

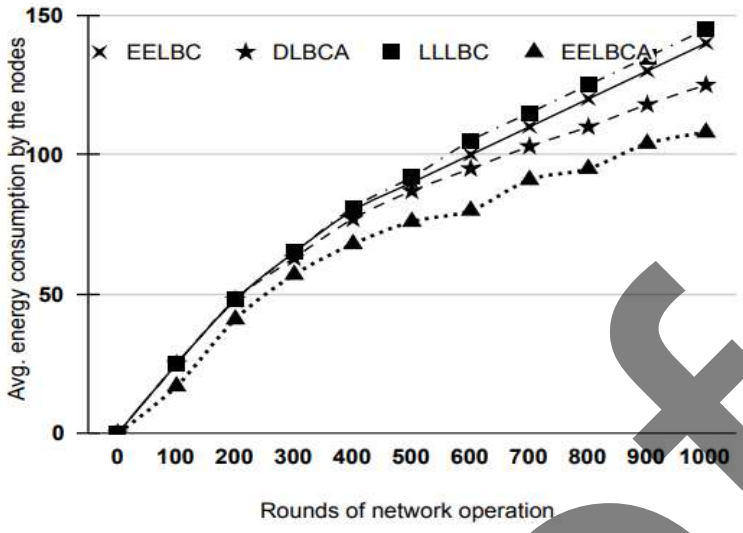

Figure 3. Average energy consumption at different rounds, 50 nodes in network of size 100*100

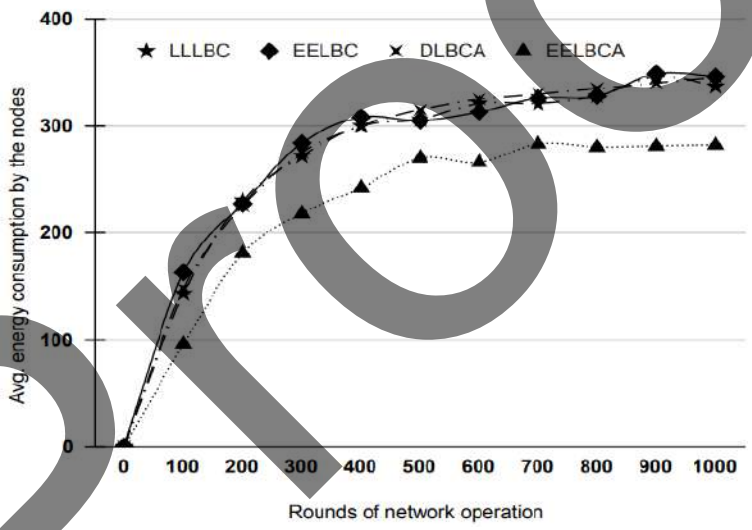

Figure 4. Average energy consumption at different rounds, 100 nodes in network of size 150*150

CONCLUSION & FUTURE WORK

In this work we have presented a simple yet effective assignment based energy efficient load balancing algorithm for IoT based clustered sensor network. Without requiring any knowledge about global network topology, our algorithm efficiently forms highly balanced cluster with simple assignments based on neighborhood information of the sensor nodes. Our algorithm works effectively on various node distributions like normal random distribution, Gaussian distribution and in grid based net-works. With simple yet explicate member assignment to cluster head nodes on the fly while formation of the cluster, our algorithm significantly minimizes the standard deviation of load among various cluster heads. Also as our algorithm do not uses centralized or global information of the network but forms the load balanced cluster with minimal neighborhood information and data exchange, our algorithm significantly out performs the existing algorithms in energy usage. Also as our algorithm do not uses sophisticated evolutionary or memetic algorithms that are computationally demanding our algorithm is readily applicable on both homogeneous as

well as heterogeneous sensor networks. In future we are looking into its modifications for RSSI based balancing and 3-Dimentional networks.

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Sensing of GFDM signal in Cognitive Radio for 5G System

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Abstract. The advancements in the wireless communication technology has led to the need of more bandwidth and this growing need is tending the wireless spectrum resources towards more scarcity. In 5G communication networks spectrum efficiency has been considered as one of the key performance metrics. Cognitive radio (CR) is considered to be the promising solution to mitigate the spectrum scarcity, and dynamic spectrum access is its core idea. At a particular point of time and geographic location the frequency band allotted to a licenced user are not being utilized by this user. In cognitive radio keeping intact the rights of primary users the dynamic utilization of the idle spectrum is done in a way that broad range of services or Number of users are able to share a particular spectrum and thus the objective to avoid the enormous cost involved in resetting the spectrum and improvement in the utility of spectrum resources is achieved. Generalized Frequency Division Multiplexing (GFDM), a flexible multicarrier modulation scheme, is one of the candidate in 5G networks to be used for the air interface. GFDM is considered to be very well suitable for cognitive radio due to the selection of pulse shaping filters in it which alleviates the out-of-band leakage problem. GFDM uses root-raised cosine (RRC) transmit pulse shaping which decreases the amount of interference suffered by the adjacent similar frequency bands. Also GFDM has tail biting cyclic prefix (CP) feature. This feature is extremely useful in cyclostationary detection of these 5G signals. In this paper, sensing of GFDM waveform using FAM for opportunistic spectrum access has been discussed.

INTRODUCTION

Recent times have witnessed explosive growth of data traffic on wireless networks. Visualizing the development of smart terminals leading to state of art applications the growth of the mobile data traffic has been estimated to be more than thousand times in the upcoming times[1]. The simple approach to accommodate the humongous amount of wireless data appears to refarm the current spectrum for finding more spectrum resources. Nevertheless, the available spectrum resource is already crowded and limited. To repurpose a spectrum band for another use it requires number of years due to regularization or standardization issues. And hence, the fifth generation (5G) communication networks are expected to solve the spectrum requirement issue with various methods. Vision for 5G networks is that they should have improvement of around 1000 times in the throughput, 10 times in spectrum efficiency and 100 times in energy efficiency [2]. 5G is expected to satisfy the diverse needs of people in varied regions, for example residence, work, Entertainment, and transportation. It will pervade the IoT also and converge the different professional areas for example medical, agriculture ,transportation and numerous different industries to perceive true interconnection of all things. In the survey of the spectrum usage conducted by Spectrum regulatory bodies of different countries it has been found that spectrum resources in large numbers remain idle in time and space dimension at times due to fixed allocation policy and also in the bands that are crowded only a certain portion of the spectrum is utilized frequently. Cognitive Radio (CR) technology opens up the possibility of reusing the valuable spectrum resource without making changes in the already existing spectrum allocation policy of the countries and thus is an aid to address the problem of low spectrum utilization rate. In 1999, the CR technology concept was first put forward by Dr. Mitola [1], and then later on Haykin gave a definition of CR from point of view of communication [2], stating it as an intelligent wireless communication system which can automatically sense the surrounding spectrum which is being used and utilize the idle spectrum found without paying hindrance in normal communication of the lawfully authorized users. These lawfully authorized or licensed users are termed as primary users (PUs) and the users not authorized spectrum or licence are termed as secondary users (SUs) or cognitive users. The principle idea of CR is to enable spectrum sharing using the technique of dynamic spectrum access, and the result is that SUs can use the vacant spectrum of PUs, ensuring no interference with the communication of PUs[3].

MOTIVATION

In wireless communications and in many modern communications systems Orthogonal Frequency Division Multiplexing(OFDM), considered to be an efficient technique is widely used. But it has certain drawbacks such as sensitivity to Inter-Carrier Interference(ICI) and a large Peak-to-Average Power Ratio(PAPR) [1]. Also the Cyclic

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Prefix(CP) does not prove to be efficient if the distribution of delay in the channel is prolonged than the CP length and also results into InterSymbol Interference(ISI) [9]. In order to mitigate these disadvantages and provide improvement different approaches have been taken in 5G. One of them is called Generalized Frequency Division Multiplexing (GFDM) which has the characteristic of low leakage outside the passband. For achieving spectrum and energy efficiency, GFDM dynamically adopts pulse shaping optimization on time and frequency in fading channels. GFDM benefits transmission of multi-symbols per multi-carrier in a two-dimensional i.e. time and frequency block-structure[3]. The block structure in GFDM is obtained by circularly convolving each individual sub-carrier with a shaping pulse. The use of pulse shaping filters enables the transmit signal in GFDM to find a good positioning in the sub-carrier frequency and thus enables reduced radiation in the stopband. Another important technique of applying windowing schemes to a GFDM block also helps to control leakage in a better amount in the stopband for small values of CPs. GFDM is very well suitable in cognitive radio because of the availability of opportunity in selecting pulse shaping filters of choice which enable in reducing the out-of-frequency band leakage to a small value. When the two techniques are compared OFDM (in which rectangular pulse shaping) is used to the GFDM (which uses pulse shaping of RRC), the latter causes lesser interference amongst the adjacent frequency bands. The important tail biting cyclic prefix (CP) feature of GFDM can be utilized in cyclostationary detection. Sensing of GFDM signal must be done reliably in such a way that if it occupies a particular frequency band than no other opportunistic cognitive radio signal transmits in that band.[10].

The remaining paper is organized in the following way-Section 3 describes the GFDM transmitter, section 4 briefly describes Cyclostationary method of spectrum sensing, section 5 presents the simulation method and section 6 discusses results. The paper ends with Conclusion presented in section 6.

GFDM TRANSMITTER MODEL

GFDM belongs to multicarrier transmission scheme which is block based and it has been derived using filter bank approach. In this the data of each block to be transmitted is spread out in time and frequency, and an adjustable pulse shaping filter is used to pulse shape each subcarrier. It is very suitable for applications involving fragmented spectrum. In this the modulated binary data is divided into KxM samples, where M denotes number of subsymbols that are lay out in K subcarriers. For filtering of these subcarriers pulse shaping filters are used since out of band radiation rendered by them is very low. The overhead of GFDM is lower than OFDM since only one CP is added to the complete data block[9]. The GFDM transmitter described is as shown in Fig.1

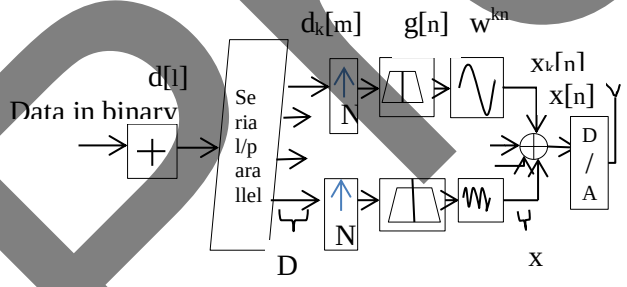

FIGURE 1. GFDM transmitter

The binary data constitutes a block structure as given in equation (1) as

D=[d0, d1,…….dk-1]T

$$\mathbf{d_k[m]} = \begin{bmatrix} \mathbf{d_0[0]} & \cdots & \mathbf{d_0[M-1]} \\ \vdots & & \vdots \\ \mathbf{d_{k-1}[0]} & \cdots & \mathbf{d_{k-1}[M-1]} \end{bmatrix} \quad (1)$$

Where $\mathbf{d_k[m]} \in C$ denotes data symbol which is transmitted mth time slot on the kth subcarrier.

The data samples dk[m] in the kth branch of transmitter are up sampled by the factor N and the resultant is

$$\mathbf{d_k^N} = \sum_{\mathbf{m=0}}^{\mathbf{M-1}} \mathbf{d_k[m]\delta[n - mN]}, \quad n=0,\ldots\ldots,NM-1, \qquad (2)$$

where δ[·] is the Dirac delta function.

And hence, $\mathbf{d_k^N[mN] = d_k[m]}$ and $\mathbf{d_k^N[n] = 0}$ for n ≠mN.

The pulse shaping filter g[n] is then applied to the sequence $\mathbf{d_k^N}$ followed by digital subcarrier up conversion. This results into a subcarrier transmit signal $\mathbf{x_k[n]}$ mathematically expressed as

$$\mathbf{x_k[n]} = (\mathbf{d_K^N} \otimes g)\,[n].\mathbf{w^{kn}} \qquad (3)$$

Where ⊗ denotes circular convolution and $\mathbf{w^{kn}} = \mathbf{e^{j\frac{2\pi}{n}kn}}$.

The transmit signals can also be presented in a block structure similar to given in equation in (1)

X=[x0, x1……..xK-1]T,

$$= \begin{bmatrix} \mathbf{x_0[0]} \ldots\ldots & \mathbf{x_0[MN-1]} \\ . & . \\ \mathbf{x_{k-1}[0]} \ldots. & \end{bmatrix} \qquad (4)$$

Now to obtain a transmit signal for the data block D all subcarrier signals are summed up according to the equation given as

$$x[n] = \sum_{\mathbf{k=0}}^{\mathbf{K-1}} \mathbf{x_k[n]} \qquad (5)$$

$\widetilde{\mathbf{x[n]}}$ is then obtained by appending cyclic extension to x[n]for doing equalization at the receiver. For reducing the length of CP tail biting [13] is applied to GFDM [7], [8] which also maintains the circular block structure in each block. The said concept of tail biting actually exploits implementation of the filters in digital domain for performing circular convolution. Then the $\widetilde{x[n]}$ is input to the Digital-to-Analog(D/A) converter and at the end $x_{GFDM}(t)$ is transmitted over the channel.

CYCLOSTATIONARITY IN GFDM SIGNALS

Any random process is considered to be a cyclostationary process if there is a periodic variation with time in its mean and autocorrelation, the statistical properties. The signals can be differentiated from the surrounding noise using Cyclostationary detectors. The reason is the natural characteristic of the noise is its randomness and when stationary it does not show a peak at non-zero cyclic frequencies. The Autocorrelation Function $R_{yy}(t, \tau)$ of the received signal r(t) is given as r(t) = r(t) = $x_{GFDM}(t)$+n(t). Here n(t) is the white additive Gaussian noise which is represented by Fourier series expansion given below

$$R_{yy}(t, \tau) = \sum_{\alpha} \mathbf{R_{yy}^{\alpha}(\tau) exp(j2\pi\alpha t)} \qquad (6)$$

where

α is a cyclic frequency,

$\mathbf{R_{yy}^{\alpha}(\tau)}$ is the Fourier coefficient which is called as Cyclic Autocorrelation Function (CAF).

Now received signal is

$$y(t)=h(t)*x(t)+n(t),$$

in which n(t) denotes Additive White Gaussian Noise and h(t) denotes the channel.

The CAF of a second order autocorrelation function is given as

$$\mathbf{R_{yy}^{\alpha}(\tau) = \lim_{T\to\infty} \frac{1}{T} \int_{-T/2}^{T/2} Ryy\,(t, \tau) exp(-j2\pi\alpha t)\, dt} \qquad (7)$$

The Fourier Transform of the CAF is known as Spectral Correlation Function (SCF) and given as

$$\mathbf{S_{yy}^{\alpha} = \int_{-\infty}^{\infty} R_{yy}^{\alpha}(\tau)\, exp(-j2\pi\alpha\tau)\ \ d\tau} \qquad (8)$$

The SCF measures the correlation of the signal in terms of the relation between its spectral components and it is not sensitive to White noise. It is used as a classifier for signals which is modulation scheme dependent.[3][4][5]. The algorithms used to calculate the SCF are classified into Frequency smoothing methods if the processing is done in frequency domain and Time smoothing methods if the processing is done in time domain. In this work a Time Smoothing method which is called as FFT Accumulation method(FAM) is used for cyclic spectral analysis of GFDM signals[7].

SIMULATION

We have considered Fifth Generation(5G) system in which the multicarrier scheme that is used is GFDM. The primary user is the GFDM signal and the analysis on its cyclostationary properties has been carried out utilizing the time smoothing algorithms in various channel environment. In GFDM the cyclic prefix timing is actually one fourth of the timing of utilizied payload. FFT Accumulation Method-FAM was used to find out the presence of GFDM signal using its cyclostationarity properties. In this method ,the division of the bi-frequency plane into small areas is done and the efficient FFT is done on each block to compute the cyclic estimate. Short time FFT is applied on main signals sequence and then the spectral components are evaluated. These spectral components are down converted to baseband by multiplying them with a complex exponential. Multiplication of one of the down converted spectral component with conjugate of another spectral component is done and then finally FFT is applied on the product obtained so multiplication to get the SCF estimate[11][12]. Tapering is reduced by the smoothing process. Decimation and Data tapering window improves spectral efficiency since processing time is reduced and also the cyclic and spectral leakage respectively are reduced by them. The simulation parameters used for GFDM are given in table1.The FAM method used for this simulation is depicted in Fig. 2. The number of received samples which is total duration of the signal frame (N) sensed used for SCF estimation was 2048 and 64 samples were taken as the sliding window length. The desired cyclic frequency resolution is 1/2048 and frequency resolution thus is 1/64

TABLE 1: Parameters used for Simulation

Specification	**Factors**	**GFDM**
Scheme of Modulation used	μ	2(QPSK)
Number of symbol samples	N	2048
Number of Allocated subcarriers	K	64
Filter Type		RRC
Factor of Roll –off	α	0.3,0.5,0.7,0.9
Channel Model		AWGN, Pedastrian A, Vehicular A

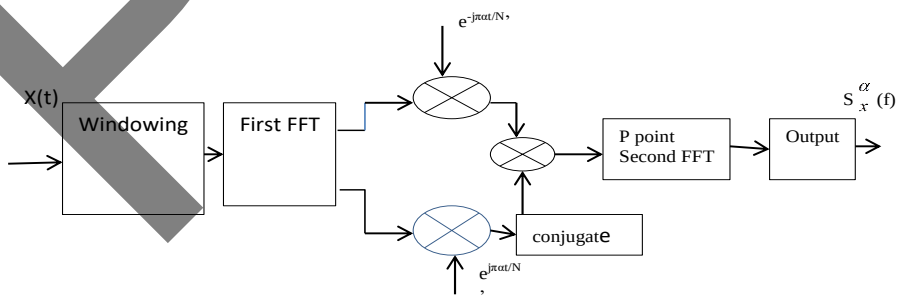

FIGURE 2. Block diagram of FAM method

SIMULATION RESULTS AND DISCUSSION

Simulation was done finding the SCF of the GFDM using FAM method . Calculations were carried out for SCF considering various magnitudes of SNR. This was repeated taking into account varied factors of Roll-off. Fig. 3 shows the variation of Detecting Probability(Pd) with SNR and the shaping filter roll-off factor. The peaks of the SCF indicate the existence of GFDM signal and this has been considered for probability of detection. Also from the figure it is obvious that the detecting probability improves as the roll-off factor increases from 03 to 0.9 for a fixed SNR.It can also be observed that considering a certain fixed value of roll-off factor the signal detection probability is improved with increase in SNR.

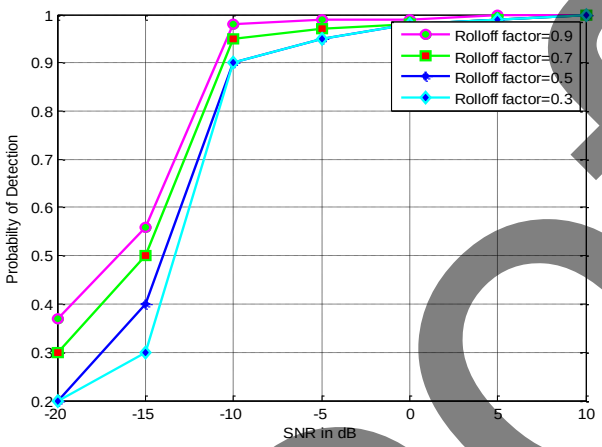

FIGURE 3. Probabilty of detection at different values of SNR for various values of roll-off factor

Fig.4 illustrates the simulation results obtained. It is plot of probability of correct detection versus SNR considered for case of 0.7 roll-off factor under different channel conditions such as Additive white Gaussian noise(AWGN) channel, ITU-R pedestrian channel and Vehicular A channel. It can be observed that the performance of correct detection degrades at lower SNRs under the Vehicular channel and needs about 2dB approximate increase in SNR to achieve a probability of almost 100% in this channel.

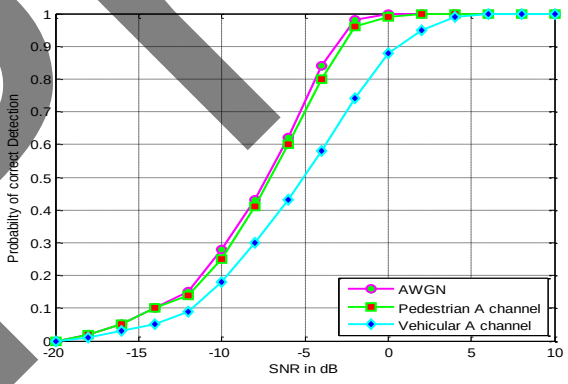

FIGURE 4. Probability of correct detection verses SNR under different channel conditions

CONCLUSION

In 5G communication the Cognitive radio is considered to be potential technology that will be used to satisfy the need of spectrum for data hungry applications and devices. GFDM is the new multicarrier 5G waveform. It has the flexibility of pulse shaping filters which reduce the out of band leakage to neighboring adjacent carriers, and thus is very apt for use in applications of cognitive radio. For the case of sensing and detecting the availability of spectrum the method of Cyclostationary is very important in the conditions of low SNR to achieve a high probability of detection. GFDM exhibits the property of cyclostationary properties and the same is utilized for detecting it in this paper. FAM method was used for detection and it was found that increase in the factor of roll-off increases the signal

detection probability. It was also observed that for low SNRs the performance is improved considering different channel conditions.

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Analysis of Facial Geometry to Identify and Extract Face Landmarks Using Transfer Learning

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Abstract. In surveillance application systems, detecting and recognizing the face assumes a significant role. Therefore, some useful information about the face may be helpful in this situation to assess the face and its structure. This information can be defined in terms of face landmarks. These landmarks represent the localization of key characteristics in terms of point. With the help of deep learning techniques, the identification of landmarks is got more accuracy in various challenging situations. These challenging situations are different postures of humans such as sitting or sleeping or standing positions. Apart from these, the expressions, illumination, occlusion, and shadow are also other factors. This paper is targeted to outline the type of face landmarks, and algorithms that are used in it with performance. The author applied a transfer learning approach with ResNet architecture on the iBUG 300-W dataset to detect the coordinates of the 68-face landmarks at left & right eyebrows, left & right eyes, nose, lips, chin, and jawline. Haar cascade classifier and DNN are experimented with to detect and localize the face. The performance is evaluated through the training loss and validation loss in each iteration on the original image and image behind the glass. The observation indicates that the train-test split training loss is 0.0008 and the validation loss is 0.0011, with the model saving 0.000995 of the minimum loss. After that, the performance is also checked on the image at the back of the glass with shadows, face pose, and occlusion for more accuracy.

INTRODUCTION

The face of a human has so much verbal and non-verbal information. This information is very useful for effective communication and interactions between two parties, such as human to human and human to machine. The face contains some key characteristics and key points, with the help of these characteristics it becomes easy to extract information such as intent, emotion, facial attributes, identity, alertness, etc. In computer vision to detect the face and landmark detection are very significant tasks. This task applies to different applications with various use cases like road traffic area surveillance and monitoring. These facial key points are used in the surveillance to estimate the head pose of the driver while driving [1]. Apart from this, the key points nearby the eyes can also be useful to estimate the pupil positions of the driver to check whether the driver paying attention or not while driving [2].

The head pose is defined by pitch, yaw, and roll. In the field of computer vision, various other related tasks and applications are dependent on face landmark detection such as face recognition, face alignment, face registration, face tracking, facial expression analysis, 3-D face reconstruction, and head pose estimation. But various challenges may be encountered while detecting and localizing the landmark points like- occlusion, face appearance, light intensity, partial or incomplete face, and face variability. The algorithms involved in it detect the coordinates of key points. Let's assume these landmark coordinates are D = (xi, yi), where x and y represent the coordinates of a landmark in the face, and i is the number of coordinates ranging from 1 to n (where, n may be: 6, 21, 68 but not limited to, it depends on the available dataset and algorithms applied on it).

ESTIMATION OF HEAD-POSE

The methods that are involved to estimate the head pose aim to assess the head orientations and positions from facial images/video concerning the camera coordinate. These methods can be categorized into –

Learning-based approaches- The approach discovers the mapping between the posture angle and appearance of the image.

Model-based approaches – The approach links the 3-D model and the 2-D facial landmarks coordinates by applying the projection model.

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The estimated pose angles could be –
Coarse–level poses (i.e., left pose, frontal pose, right pose).
Fine-level poses (i.e. pitch, yaw, and roll sequentially angles of X, Y, and Z axis).
Figure 1 depicted the head-pose fine-level poses and landmarks on different occlusion images, such as the image behind the glass with different light intensities.

FIGURE 1. Detected head-pose and landmarks on different occlusion images, the image back of the glass with different light intensity

Face recognition relies on the geometry of the face like the distance between - both eyes, forehead to chin, nose length, and length of lips. Face geometry includes a set of points that are available on a face. as available on "Face detection and attributes - Face - Azure Cognitive Services", 2022 [3], all pre-identified landmarks highlighted by red dots.

The localization and the precise detection of these facial features in the 2D face image along with the 3D head model is an introductory process to re-generate the face. This precise information solves different problems of face recognition applications such as surveillance, human-to-computer interaction, medical, and biometric applications [4–7]. Even face analysis tasks like gender classification and age estimation as deep analysis of facial attributes purely rely on the face landmarks components and methods [8,9]. Recently, the mediapipe library is also used to generate the face-mesh by using 468 landmark coordinates. Figure 2 is the face mesh result, generating 468 landmark coordinates using the mediapipe library.

FIGURE 2. Face mesh result with 468 landmarks at different occlusion using mediapipe

In figure 2, it can be observed that face posture matters. In the output first, third, fourth, and fifth images have face-mesh through 468 landmarks, but the second image does not. Different databases configure the different landmark points, and for convenience, the facial landmarks can be categorized into - Primary (fiducial) and Secondary (ancillary) as shown in table 1 Face landmark groups and roles.

TABLE 1. Face landmark groups and roles

S. No.	Facial Landmark Group	Facial Landmarks	Accessibility	Role
1	**Primary or Fiducial**	Center of eye Inner and Outer corner of the left eye Inner and Outer corner of the left eyebrow Inner and Outer corner of the right eye Inner and Outer corner of the right eyebrow Nose tip Corner of left & right mouth corner	By applying low level image features gradient information	Facial Identity. Face Tracking.
2	**Secondary or Ancillary**	Left eyebrow contours Right eyebrow corners Center of the upper eyelid Center of the lower eyelid Left temple Chin tip Cheek contours Right temple Nose saddles Nose peaks (Nostrils) Nose contours Mouth contours	By using primary landmarks	Facial Expression

RELATED WORK

As per the systematic survey conducted in [10], the dataset contains subject images in different conditions with variations such as emotion, facial expression, illumination condition, and pose. Table 2 is showing the openly accessible datasets for facial landmark detection, each dataset is captured from different sources.

Face alignment is also a very important field of computer vision. In this context, [11] presented a model which works concurrently on facial appearance and shape modeling. In the work, SRD (Stage-wise Relational Directory) model has been derived and extended as HSRD (Hierarchical version of SRD) and added the occlusion directory, later introduced as an OSRD. Face alignment later may be used to reconstruct the face. This is also a very promising area of research and is widely accepted in various surveillance techniques. [12] obtained 3-D coordinates of 68 human facial landmarks through CE-CLM (Convolutional Experts- Constrained Local Model). This practice enables dynamic facial feature construction.

TABLE 2. Publicly available facial landmark datasets

S. No.	Dataset	Description	Number of Annotated Landmarks	Visualization
1	AFLW [16]	The dataset has 25K wild faces with different head poses.	21	
2	AFW [17]	The dataset contains 468 faces in different 205 pose images.	6	
3	AR [18]	The dataset includes 13 sets of 4K color photos of 126 persons with various occlusions, illumination variations, and facial expressions. However, posture is the sole restriction.	22	
4	LFPW [19]	The dataset includes 287 pictures that were downloaded from yahoo.com, flicker, and google.com. There are vast variations in the poses, facial expressions, lighting, and occlusions in these pictures.	35	
5	XM2VTS [20]	The XM2VTS dataset contains a total of 2360 front face images of 295 subjects in similar illumination and neutral expression.	68	
6	HELEN [21]	The dataset contains 2330 Uncontrolled images, collected from web–flicker.	168	
7	Multi-PIE [22]	The Multi-PIE is the largest dataset and has 7,50,000 photos of 337 different subjects. Each subject features 15 different positions, 19 different lighting effects, and 6 different expressions, including neutral, surprise, disgust scream, smile, and squint.	68	
8	iBUG [23]	As the initial version of the 300-W challenge, the iBUG dataset was released. Expression, lighting, and position are only a few of the many variations in the pictures.	68	

TRANSFER LEARNING

The systematic survey on transfer learning [13–15], represented that transfer learning, particularly in computer vision, is a technique where the knowledge gained from a pre-trained model is used to address the solution of a new problem. In transfer learning, a machine takes advantage of the information acquired from a past undertaking to further develop speculation about another related task. It also transfers the weight acquired from the previous task to a new task. This approach reduces the training time and resources. There are three different settings available for transfer learning- Inductive, Transductive, and unsupervised as shown in figure 3.

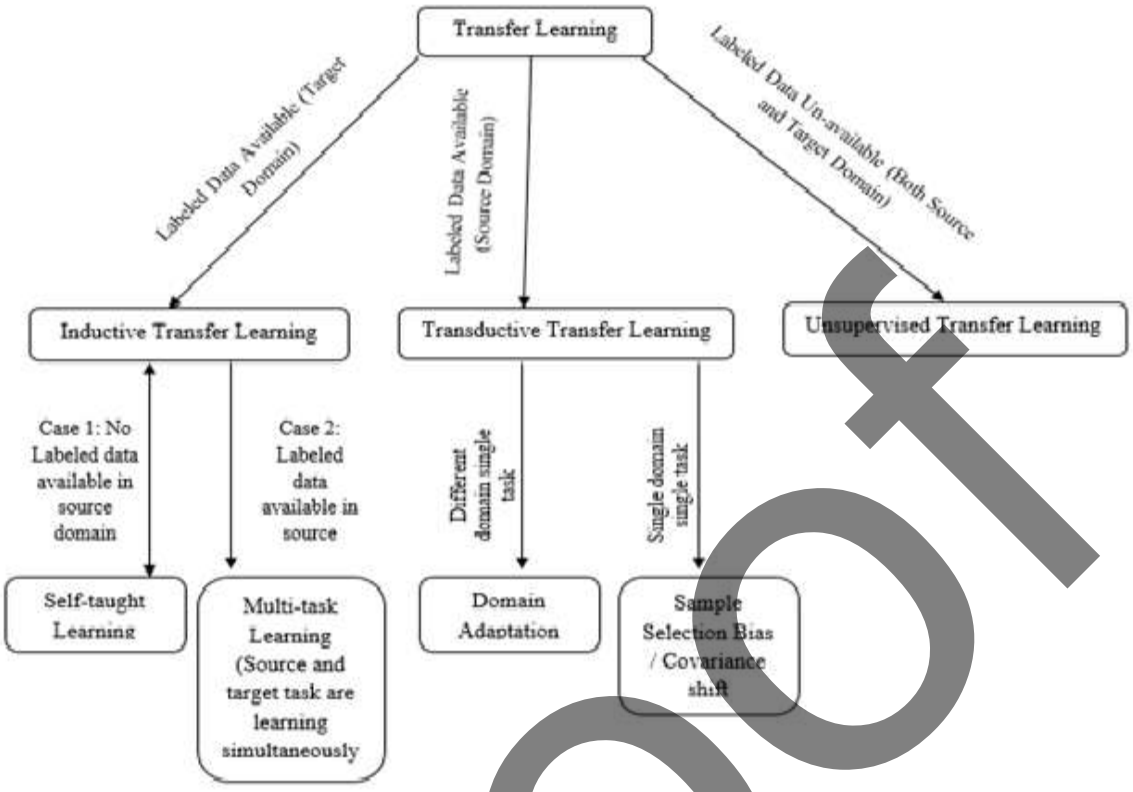

FIGURE 3. Three various settings of transfer learning

There are three main approaches to transfer learning: homogeneous, heterogeneous, and negative transfer [15]. The Attentive Feature Distillation and Selection (AFDS) is a dual attention technique aiming to gain the improvements of transfer learning methods. Earlier the transfer learning was based on the deep network by assuming that the knowledge should be transferred between the same hidden layers of the source domain and target domain, but it is not suitable when the resolutions are different, and the domain is heterogeneous.

32 reflecting markers, comprising 4 stabilizer markers and 28 smaller markers for facial expression, are discussed by [25]. A total of 9 distances, including 1 face distance, 3 eye distances, 2 nose distances, and 3 mouth distances, were taken for analysis. Mostly face landmarks detection is based on the traditional work i.e. first detect the face and then detect the facial landmarks, but here the performance is completely dependent on the face detection model.

Single-shot detection (SSD) model based on YOLOv3 was introduced by [26] to detect faces and landmarks concurrently. Additionally, the utilization of EfficientNet-B0 as a backbone increases processing speed and accuracy. The model refrains from the conventional YOLOv3 in that it guesses the class of the object rather than the landmark coordinates of the face. Because the modified model put away the information regarding the bounding box and included the landmark coordinates in place of the class probability. Research has varied in the approach because they used the varying facial appearances of input images like different occlusion, variations, and shape information.

The analysis of facial information in global and local contexts has been divided into two stages [27]. For local context information, local pixel level correctness was attained in the first stage. And in the second stage, each important point in the image was integrated with knowledge of the spatial relationships between them for the overall context. The approach attains state-of-the-art performance without any post-processing on LFPW, HELEN, 300W, and AFLW2000-3D datasets by taking the benefits of FC-DenseNets, skip-connections, and dilated convolution. The FC-DenseNets with a heatmap regression worked as a local detector. As a result of the input image, it predicts dense heatmaps. The predicted heatmap of the face important points was further refined using the dilated skip convolution (DSC) network. By combining a stack of dilated convolutions and a skip-connections method, this objective is accomplished. [28], uses a projection matrix and Levenberg-Marquardt optimization-based mathematical technique to compare the 2-dimensional coordinates of the facial image (which is obtained from the video) and the real-world facial coordinates to determine the Euler angles of the face.

On Multi-PIE dataset [29] uses the haar cascade classifier for face detection and Histogram Oriented Gradients with SVM to detect 68 points. Initially, the distance is measured between the landmark points and later the measured value is fed into the SVM classifier. As the regression and classification-based approaches are mostly used to solve such above stated problem. Therefore, the facial landmark extraction algorithms are mainly categorized into two categories- discriminative (binary classification to separate the object and background) and generative (object representation and search the similar object without background information) [30]. The cascaded regression model (CRM) is one of the discriminative models. The ASM (Active Shape Model) [31], Boosted Regression Active Shape Model [32], Active Appearance Model [33–35], and Bayesian AAM [36] are some of the generative models focused to model face shape and their appearance.

METHODOLOGY

Deep CNN has attained effective outcomes in the field of Computer Vision tasks. These tasks majorly included image recognition and image classification. This can be possible by adding more and more layers to the network or architecture. As a result, adding more layers makes the training difficult and sometimes it may also observe that the accuracy saturates, and performance degrades. But ResNet (Residual Network) (He et al.) [37] was found to achieve convincing performance on very complex problems like object detection and face recognition. Here, the training is easily possible on more than hundreds of layers. The ResNet is made-up of residual blocks that skip some layers (identity shortcut connection) as shown in figure 4.

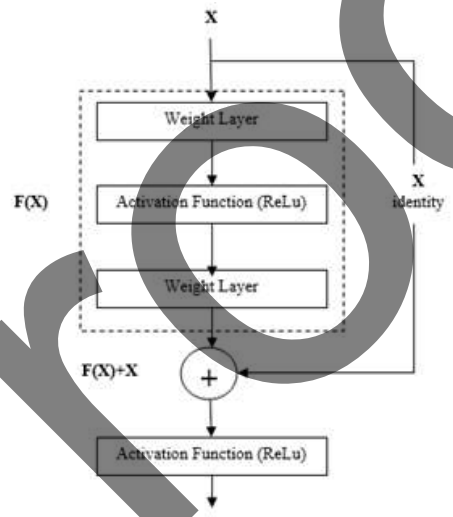

FIGURE 4. Residual block (Residual Learning)

The intention is to skip the connection to let smooth gradient. And also confirms that the essential features must be reached out to the last layers.

The entire process does not add any other computational load. The X in the aforementioned residual block is the result of the preceding layer, which is later used as an input to the ResNet block (also known as residual), while F(X) is a neural network made up of numerous convolutional blocks.

There are mainly 3 components-

Input layer (Referred as layer-0) : conv1+ max pool.

ResBlock (Referred as layer1-layer4) : conv2 without max pooling - conv5.

Last Layer.

Figure 5 depicts the architecture of ResNet18 and this architecture will be used as a basic framework in the approach to detect the 68 landmark coordinates as (x, y) points, hence values that need to be found are 68X2=136. Therefore, the total number of classes is 136 in the work.

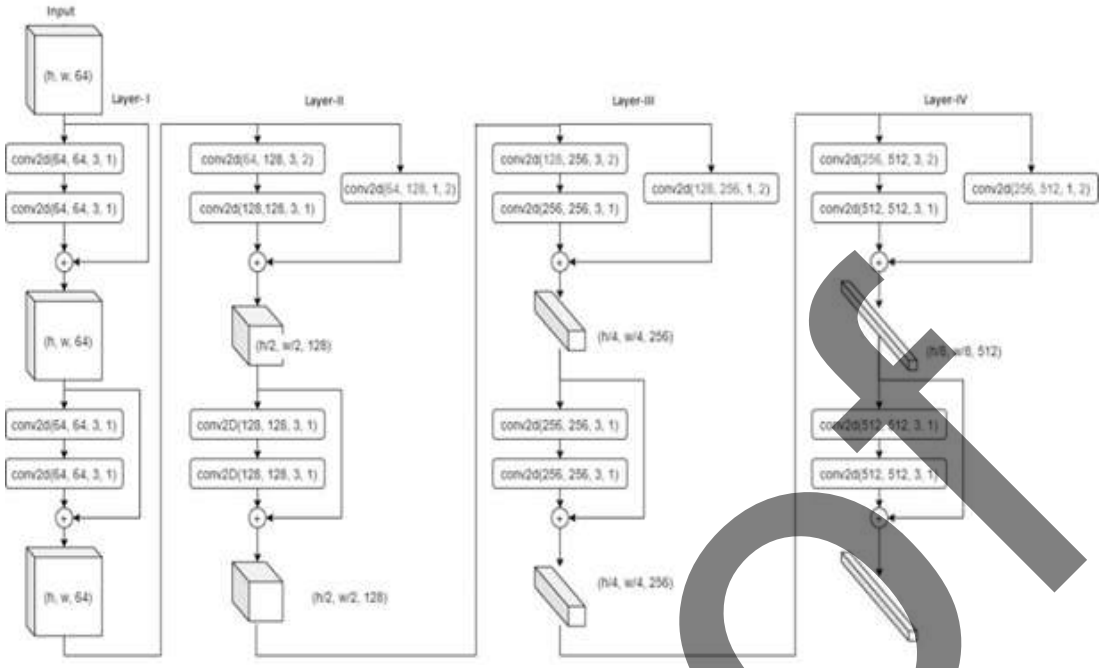

FIGURE 5. Basic ResNet18 Architecture

With the help of transfer learning, the pre-trained model is re-used to take advantage of previously acquired knowledge and past understanding. The weight gained from the previous task will be updated, and the new model with updated weight can solve the new task (i.e., to detect the coordinates). This approach reduces the training time and resources. the learning of the basic framework will be used to solve the problem of landmark detection.
In the proposed model the basic framework is modified. The changes are made in the first layer and the last layer because the first layer is based on the type of input and the last layer parameters are based on the output. The modifications are based on the assumption that the input layer will accept the single grayscale image so it will require a single count but to generate the landmark coordinates x and y for 68 landmark points it will require 136 output channels.

To prevent the neural network model from overfitting situations random transformation was applied on cropped 224 X 224 face image. Some other transformations will also be applied to the cropped input data such as brightness, saturation, and rotation. For scaling, normalize the image and landmarks between -1 to +1. The modified model is illustrated in figure 6.

Model Construction

Algorithm 1- Model definition using transfer learning

1. Create model class with super class nn.Module
2. Initialize the constructor-
   - With 136 Classes as an argument (68 landmarks X 2 Coordinates (x,y))
   - Load pre-trained base model ResNet18
   - Apply transfer learning on base model and modify the architecture-
     - Adding fully convolutional layer in the beginning with kernel size-7, stride rate-2, padding-3.
     - Adding fully connected layer with required number of classes in the output
3. Return the model

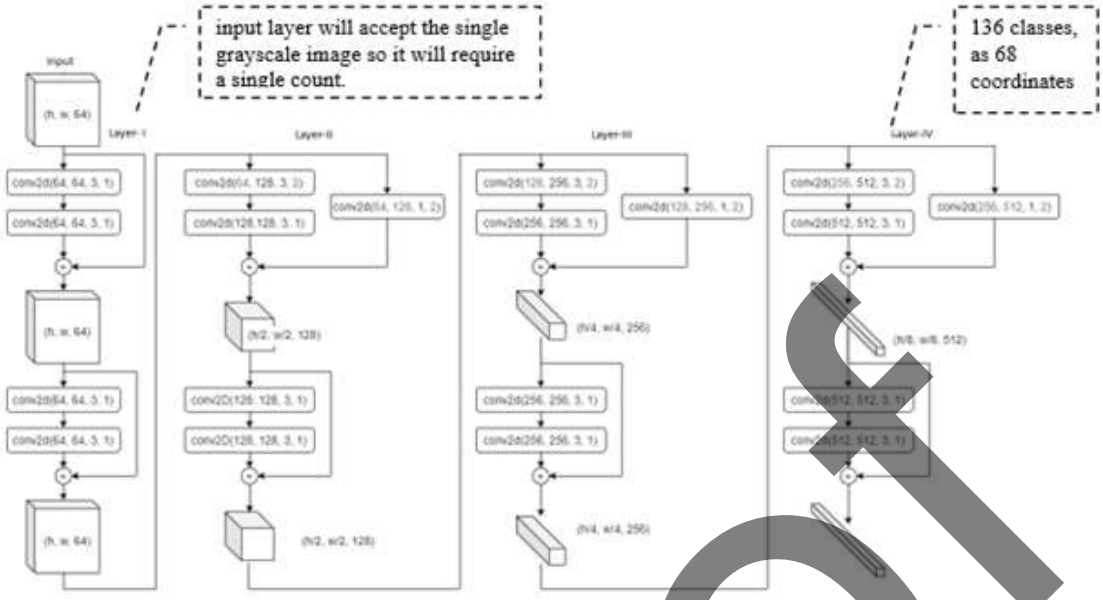

FIGURE 6. Modified ResNet-18 Architecture

Algorithm 2- Training

1. Create network object
2. Select MSELoss
3. Select Adam optimizer and 20 epochs
4. [Outer For loop begin] for epoch 1 -> num_epochs+1:
   - A. Set training loss, validation, and minimum loss to 0
   - B. network.train ()
   - C. [Inner for loop begin] for step 1-> length of train_loader+1:
     - (i) Iterate train_loader
     - (ii) Clear gradients
     - (iii) Calculate training loss
     - (iv) Recalculate gradient and optimize the parameter

     [End inner loop]
   - D. Evaluate the network

   [End outer loop]

EXPERIMENTAL SETUP

In this paper, the author detected the landmarks using the DLib Dataset and labels_ibug_300W_train.xml. The dataset contains a total of 6666 images in different dimensions and 68 landmark coordinates associated with each face. All execution done on i7 GPU CUDA enabled machine and google Collaboratory. To make the process easy and simple, before feeding the input image to the model first detected the face from the image and then made it compatible with correspondence to the model as the face occupies less space in the image, but some other irrelevant information is also there. To detect the face and crop that portion the Harr Cascade Classifier is used. The classifier is pre-trained on the set of input data to detect the face, eyes, etc.

Implementation

Below are the steps of the complete process and implementation-

Step-1: Load the dataset – in this paper DLib Dataset and labels_ibug_300W_train.xml are used.

Step 2: Data pre-processing- It is the main activity for every machine learning and deep learning process. Before feeding the data directly to the model some pre-processing, and cleaning requires. Here, the Haar Cascade Classifier is used to detect the face and crop into the size of 224 X 224 in grayscale.

Step 3: Transformation of dataset- to prevent the neural network model from overfitting, the random transformation is applied on cropped 224 X 224 face image.

Step 4: Some other transformations were also applied to the cropped input data such as brightness, saturation, and rotation. For scaling normalize the image and landmarks between -1 to +1.

Step 5: Define the dataset class with 0 centered.

Step 6: Apply the train test split and create the data loader with a number of workers 4.

Size of train and test data: -

- The length of the Training dataset: 5667
- The length of the Validation dataset: 999

The shape of input data: -

- torch.Size([64, 1, 224, 224])
- torch.Size([64, 68, 2])

Step 7: Designed the neural network by applying transfer learning. The input layer will accept the single grayscale image so it will require a single count but to generate the landmark coordinates x and y for 68 landmark points it will require 136 output channels.

EVALUATION AND RESULT

The model was trained using parameter values for batch size, kernel size, stride, padding, and learning rate in the order of 64, 7, 2, 3, and 0.0001 at 20 Epoch in order to assess its performance. The helper loss function was used to calculate the MSE (Mean Squared Error) between the real landmark coordinates and predicted coordinates, and the Adam optimizer was used to further improve the model. MSE was calculated at every epoch to calculate the minimum loss. The minimum loss represents the good accuracy of the model. To examine the effectiveness of the own model, XceptionNet was used on the same data. Table 3 represents the comparison between XceptionNet and own proposed model based on training loss at 10 epochs. Figure 7 (a) is visualizing the comparison and performance of both models. Further to a more accurate performance of the model, it is again trained at 20 epochs. The model saved at a Minimum loss of 0.000995 with a Validation Loss of 0.0011 and a Training Loss of 0.0008 via elapsing the complete training time 12721.396213054657 s as shown in figure 7 (b). The running loss and minimum loss are depicted in figures 7 (c), and (d) respectively.

TABLE 3. Result comparison of XceptionNet and Own Model (MSE – Training Loss)

Epoch	MSE (Training Loss) XceptionNet	MSE (Training Loss) Own proposed model
1	0.012424	0.023476
2	0.007565	0.005735
3	0.006336	0.005016
4	0.005302	0.004184
5	0.004263	0.003039
6	0.003668	0.002323
7	0.002992	0.001921
8	0.002682	0.001628
9	0.002424	0.001464
10	0.002181	0.001362

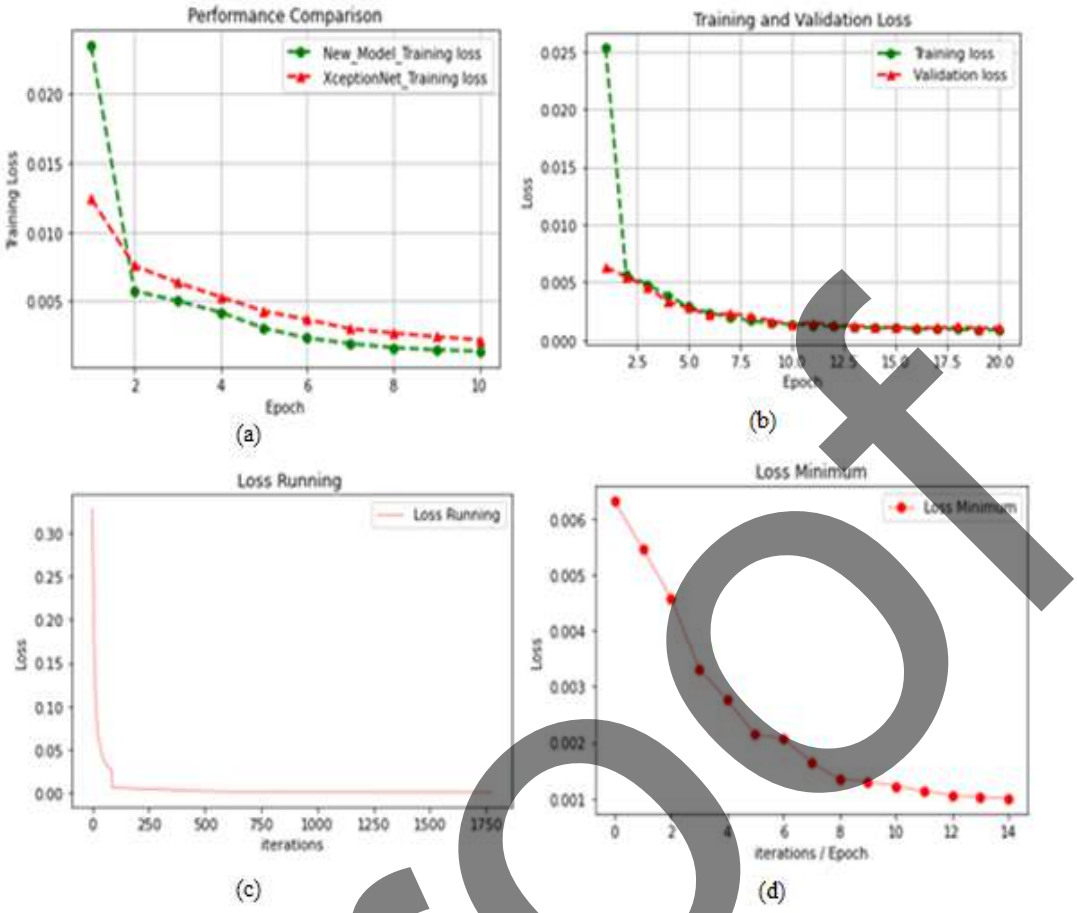

FIGURE 7. (a) Performance Comparison on MSE training loss at 10 epochs, (b) Training Loss and Validation Loss at 20 epochs, (c) Running loss in every iteration, and (d) Minimum loss in every iteration and epoch

Figures 8 depicts the face geometry and approximate face shape. Figure 8 (a) shows the actual and predicted landmarks only (without image) in order, with green and red colors. The red landmark is one that the model identified, while the green landmarks are the actual landmarks as they are present in the dataset. It can be easily observed that the produced result is much more accurate than the available landmarks. Figure 8 (b) is only representing the predicted landmarks with green colors. Further, these landmarks can be re-used to construct the 3-D face and approximate face geometry.

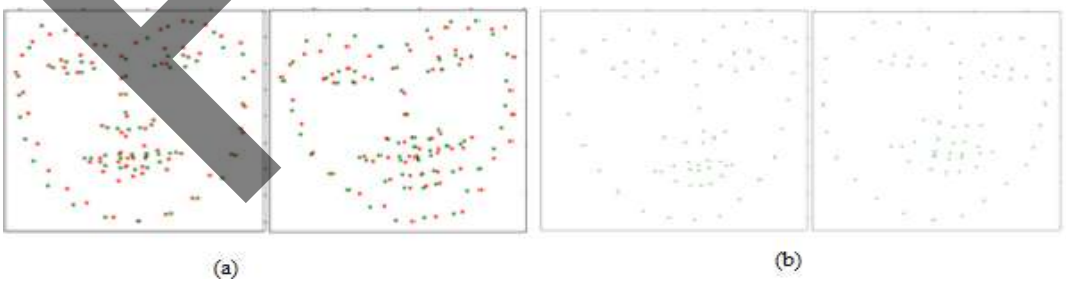

FIGURE 8. (a) Face shape with actual (green) & predicted (red) Landmark, (b) Predicted (green) Landmarks

CONCLUSION

The author examined numerous face landmark detection methods and algorithms in this work. Different face landmark kinds, including 17, 29, 51, and 68 points, applications, and datasets were discovered through the systematic study of the literature and related work. With this paper author also provided a new perspective to use transfer learning

and various approaches to transfer the knowledge of one model to another. In this paper, three different settings for transfer learning- Inductive, Transductive, and unsupervised reviewed to provide new research directions. The author discussed how to reduce the training process by re-using the weight or previously trained model for task-A to solve task-B. The author detected the face landmarks on different face positions, occlusion, and the image behind the glass with shadows and different light intensities. Various types of datasets involved to detect the landmark coordinate are also discussed in this paper and the result of face-mesh using mediapipe demonstrated to provide a clear path to the researchers. In this paper, the author applied transfer learning on ResNet18, in future work transfer learning will be applied on ResNet101 and 152 or in the advanced architecture.

ACKNOWLEDGMENTS

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Personalized Marketing and Targeted Advertising

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Abstract. Beginning in the early 1990s, web developers began tracking HTML calls that their websites were receiving from online visitors. In 2012, the Web Analytics Association (WAA) officially changed its name to the Digital Analytics Association (DAA) to accommodate new and developing data streams that exist in addition to the web. Tracking the information from websites and using it for marketing is done by various companies for so long. This paper summarizes the various methods used for performing targeted marketing. The objective of our research is to understand the marketing strategies used by various companies, helping them in planning their strategies depending on their audience. It is seen that nowadays marketing strategies used by different companies are performing an important role. The companies as well as various organizations are trying to understand customer behavior and plan the strategies accordingly. However, the perception concerning marketing strategies is that it needs significant improvements to understand customer behavior and their demands. The marketing strategies have made a significant impact, but there is more to be done to achieve more accurate results and planning. The companies collect customer data for marketing purposes. If this data is used properly to plan marketing strategies, it will help the companies in achieving good results. The rapid pace of innovation in the field of Artificial Intelligence (AI) is turning the far-fetched dreams of yesterday into advances of today. Artificial intelligence matches our desires with the exact information, product, or service we need, at the right time. It is increasingly being used to improve search results, and it will be the driving force behind the changes in content production, target marketing, and advertising. Personalization based on data has become critically important in digital marketing, but many marketers still use outdated methods, with business rules created through online analysis of collected data. These rules are implemented in an automated way via a business rules engine that accumulates all the rules over time, including old efforts that no longer work. This process is very inefficient for driving customer acquisition, conversion, and retention effectively.

INTRODUCTION

Personalized marketing is gaining headway and has become a point of popular interest with the emergence of relevant and supportive technologies. Traditional forms of advertising, including billboards, newspapers, magazines, and radio channels, are progressively becoming replaced by online advertisements. Knowing the demands of the audience, understanding customers' behavior, and planning marketing strategies accordingly is the most popular strategy being used by many organizations/companies.

Personalized marketing also known as individual marketing is getting more popular day by day. An organization can track a customer's interests through the website and make suggestions for the future. Also, many sites help customers make choices by organizing information and prioritizing it based on the individual's liking. Many retailers attract customers to the physical store by offering discounted items that are automatically selected to appeal to the individual recipient. Bringing suitable offers for a targeted audience helps the retailers to reach a maximum number of people and make the utmost profit. For this purpose, a huge data is collected, filtered, and analyzed. Using popular algorithms, this data is used properly such that retailers can bring suitable offers for a specific set of customers.

DIFFICULTIES

The major difficulties faced by companies in personalized marketing are:

1. Not using adequate technologies
2. Not being able to sync and analyze the right data together at the right time.
3. Not thinking about triggers
4. Not being able to share the data across companies (hierarchical companies)

OUTLINE

This article consolidates how the right methods can help in understanding customer behavior. It also provides information for planning the marketing strategies. Moreover, the article identifies potential future research areas related to personalized marketing and targeted advertising.

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REMAINDER

The remainder of the paper is organized as follows: The first section is an introduction. The literature review titled Authors and Affiliations is discussed in section D. The methodology including the structure of the project and the steps used is discussed in section E and section F. Section Results displays the results/output of the project. the future scope is discussed in the next section. Finally, the last section concludes the paper with potential future directions.

AUTHORS AND AFFILIATIONS

Substantial research has been reported in the literature to explore different methods for Personalized marketing. Few papers discuss the information of companies that use various personalized marketing techniques like Netflix, Starbucks, Amazon, etc. The authors of the paper with the title Hyper personalization in the e-commerce sector discuss the examples of Hyper-personalization marketing, its advantages, and data privacy challenges [10]. Another paper titled E-commerce Hyper-Personalization discusses various types of digital marketing, e-commerce, and their advantages [11]. The focus of ad targeting is to maximize the effectiveness of given advertisements by managing their recipients (audience targeting), timing, and placement (contextual targeting) (Raeder et al. 2012). Personalization increases ad effectiveness only on motive congruent websites but decreases it on incongruent websites [17]. One way in which targeted advertisements reach desired consumers is through behavioral targeting (BT). Additionally, the user's search queries also help to determine which advertisements should be displayed to the user by matching them to the advertiser's keywords [2]. In an AI-powered workplace, individuals' awareness of their role in producing and sharing value is critical to the success of their careers, the organizations they work for, and the customers they deal with. As a result, AI may soon usher in a fundamental shift like marketing [18]. Research work discusses the scope of personalized marketing, its impact on the customers, and its advantages. Since the papers have discussed the effect of personalized marketing, advantages/disadvantages, and comparisons, we will discuss the actual use of technology for recommending the offers/products to the customers based on the data. We will discuss how the machine learning algorithms help in recommending the relevant offers/products to the customers.

METHODOLOGY

The approach for personalized marketing used by the most successful digital companies (Google, Netflix, Instagram, Twitter) is machine learning. Self-learning sense-and-respond systems do the challenging work of analyzing data and writing business rules in real-time. Once these rules are applied, the data analytics system evaluates the efficacy of the rules based on success or failure and adjusts accordingly. This way, the rules evolve and improve over time, continually advancing business outcomes by delivering insights for marketers.

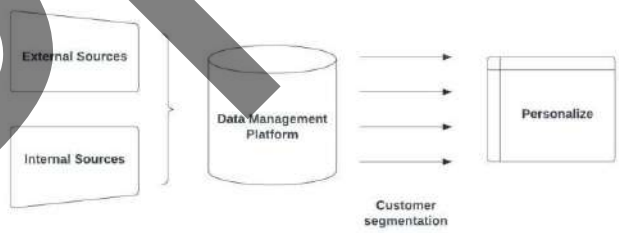

FIGURE 1. Methodology

One-to-one marketing is based on four main steps to fulfill its goals:

1. **Identify:**

To collect reliable data about the preferences of the customers of the company. The data includes first-party data like customer id, gender, income, age group, location, membership, preferences, etc.

2. **Differentiate:**

To distinguish the customers in terms of their lifetime value to the company, their priorities, and needs, and to segment them into more restricted groups. This classification is done after filtering the available data and analyzing it.

3. **Interact:**

To get the customer's attention by engaging with him through the communication channels and in ways that he enjoys the most.

4. **Customize:**

To personalize the product or service to the customer individually using the knowledge that a company has about a customer via machine learning tools/algorithms. Building a recommendation system based on available data.

PROCESS

Personalized marketing is dependent on technology for data collection, data classification, data analysis, data transfer, and data scalability. Technology enables marketing professionals to collect first-party data such as gender, age group, location, income, membership if any, preferences, etc. and use this data to build targeted recommendations based on customers' choices. Following are the three basic steps to be followed while building a recommendation system for personalized marketing:

Data collection: The dataset chosen is from a well-known company named Starbucks. The dataset is available on www.kaggle.com. The chosen dataset has many attributes. Checking the provided CSV files and deciding the suitable ones comes in data cleaning and filtering. Merging the dataset files as per the requirement and making them suitable for further processing is done in this step. The other actions performed include dealing with the null values, and duplicate values, dropping the unnecessary attribute, merging the files, and filtering them as per the requirement

Dataset Preparation: Preparing the dataset includes considering the suitable attributes, performing label encoding, and checking/changing the data types wherever required. It includes removing unnecessary characters, words, or numbers present in the dataset. Sometimes steps like dropping the unnecessary attributes, dividing the numerical data into sets, and converting categorical data into labeled data are required while preparing the dataset. Also, dividing the data into offers, users, and rewards., i.e. performing customer segmentation. And finally making the dataset perfectly suitable for the modeling process.

Data Modelling: Understanding the variations in the data and deciding the dependent variables and then recommending the required attributes using a suitable algorithm. There are various classification algorithms. Using the most suitable algorithm considering the factors like data availability, the structure of data, and correlation between attributes is very important. The algorithm used here is the kNN (nearest neighbor) algorithm. kNN algorithm is one of the classification algorithms. It is a supervised learning algorithm.

kNN Algorithm: This classification algorithm assumes the similarity between a new data point and available data points and put the new data point accordingly in the most similar category. kNN algorithm is simple to implement. It is very useful when used with large data. As companies collect huge data from their customers, the kNN algorithm can be used efficiently for building recommendation systems. Here, this algorithm helps in recommending suitable offers to the customers based on their previous preferences. With the below figure the working of the algorithm can be understood.

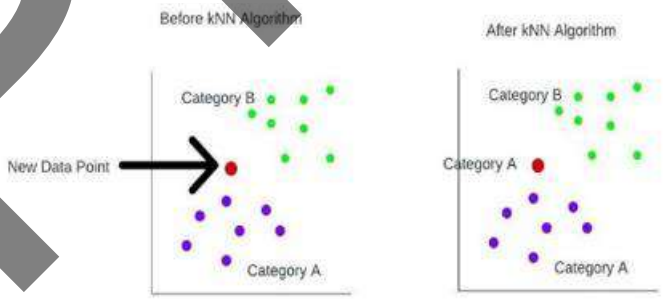

FIGURE 2. kNN Algorithm

With the help of the above algorithm, a recommendation system is created. There are two main types of recommendation systems:

Content-based recommendation: Content-based filtering uses item features to recommend other items similar to what the user likes, based on their previous actions or explicit feedback. In content-based recommendation systems, the interest of a specific user is taken into consideration.

Collaborative Filtering: Collaborative filtering uses similarities between users and items simultaneously to provide recommendations. In collaborative filtering recommend an item to user A based on the interests of a similar user B.

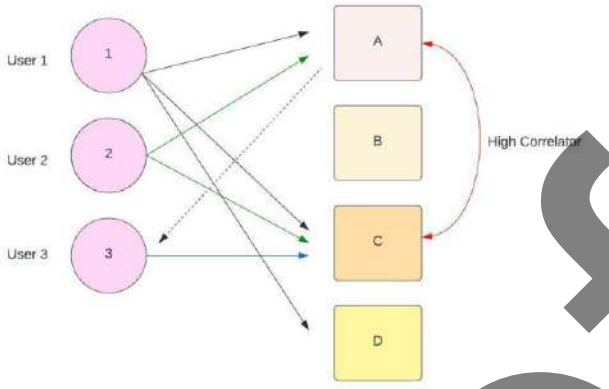

FIGURE 3. Item-based collaborative filtering

RESULTS

```
Offers received by user 1 : [5, 5, 6, 3, 3, 8, 1, 8, 1, 8, 6, 6, 1]
Offers to be recommended to user 1 : [87, 119, 87, 119, 18, 72, 4, 52, 4, 52, 8, 126, 96, 139, 8, 126, 96, 139, 8, 126, 18, 72, 18, 72, 96, 139]

Offers received by user 2 : [4, 4, 9, 9, 5, 7, 9, 5, 4, 9, 9]
Offers to be recommended to user 2 : [4, 52, 4, 52, 21, 29, 21, 29, 87, 119, 43, 47, 21, 29, 87, 119, 4, 52, 21, 29, 21, 29]

Offers received by user 3 : [6, 8, 8, 8, 1, 1, 5, 5, 6, 1, 6]
Offers to be recommended to user 3 : [18, 72, 8, 126, 8, 126, 8, 126, 96, 139, 96, 139, 87, 119, 87, 119, 18, 72, 96, 139, 18, 72]

Offers received by user 4 : [9, 9, 9, 9, 3, 3, 0, 0, 9, 5, 5, 5]
Offers to be recommended to user 4 : [21, 29, 21, 29, 21, 29, 21, 29, 4, 52, 4, 52, 8, 126, 8, 126, 21, 29, 87, 119, 21, 29, 87, 119]

Offers received by user 5 : [8, 9, 8, 5, 2, 2, 9, 5]
Offers to be recommended to user 5 : [21, 29, 21, 29, 8, 126, 87, 119, 158, 313, 158, 313, 21, 29, 87, 119]

Offers received by user 6 : [8, 9, 9, 9, 8, 8, 3]
Offers to be recommended to user 6 : [8, 126, 21, 29, 21, 29, 21, 29, 8, 126, 8, 126, 4, 52]

Offers received by user 7 : [9, 7, 9, 9, 7, 8, 8, 8, 8, 8, 9, 9, 8, 9]
Offers to be recommended to user 7 : [21, 29, 43, 47, 21, 29, 21, 29, 43, 47, 8, 126, 8, 126, 8, 126, 8, 126, 8, 126, 21, 29, 21, 29, 8, 126, 21, 2
9]

Offers received by user 8 : [7, 7, 7, 7, 7, 7, 6, 7, 6]
Offers to be recommended to user 8 : [43, 47, 43, 47, 43, 47, 43, 47, 43, 47, 158, 313, 18, 72, 43, 47, 18, 72]

Offers received by user 9 : [6, 0, 1, 6, 1, 0, 3, 1, 6, 3]
Offers to be recommended to user 9 : [18, 72, 8, 126, 96, 139, 18, 72, 96, 139, 8, 126, 4, 52, 96, 139, 18, 72, 4, 52]

Offers received by user 10 : [7, 3, 7, 8, 2, 2, 8, 7, 2, 4, 0, 8, 4, 0]
Offers to be recommended to user 10 : [43, 47, 4, 52, 43, 47, 8, 126, 158, 313, 158, 313, 8, 126, 43, 47, 158, 313, 4, 52, 8, 126, 8, 126, 4, 52, 8,
126]
```

FIGURE 4. Offers to be recommended

In this recommendation system for personalized marketing, the preferences of individual customers are taken into consideration. Based on their choices, similar types of offers are suggested by the recommendation system using KNN Algorithm. KNN Algorithm works considering the behavior of the neighbors. Here, the above results suggest which offers should be recommended to customer number 1. The numbers in the output are Offer IDs. Based on the customer's preferences, similar offers are suggested to the respective customer. As some of the offers are availed by the customers more than once, recommendations are based on those inputs. Using this recommendation, the marketers can offer the recommended offers to their customers using Social Media, Emails, messages, etc. The above results are an example of how a recommendation system can work efficiently and help in targeting the right audience with suitable offers. Similarly, companies can use the above recommendation system to recommend products to their customers. These recommendations make the process of personalized marketing easier and more efficient. Machine Learning technology works efficiently in understanding the customer behavior, their preferences and recommends the most suitable choices for the respective customers.

FUTURE SCOPE

There are various difficulties in performing personalized marketing and targeted advertising. Some of the difficulties and challenges are as follows:

a. ***Data Collection*** – The data collection is sometimes challenging. Without proper and suitable data, planning marketing strategies becomes difficult.
b. ***Privacy issues –*** Collecting customers' data and using it for marketing purposes can be harmful. There are certain privacy-related issues that a company might have to face while using the data.
c. ***Lack of data*** – Sometimes the data owned by companies is not sufficient to plan the strategies. Not having proper and wholesome data might cause inappropriate recommendations.
d. ***Lack of technology*** – Sometimes not using proper technology causes inappropriate marketing strategies which result in wrong recommendations which might cause a loss.
e. ***Insider attacks*** – Companies have to secure and store the data properly. Lack of securities might cause data leakage and can be a big threat to the company.
f. ***Inappropriate responses*** – Sometimes the responses from the customers are not appropriate. There can be missing values in the data or some wrong/duplicate entries. So, the company has to deal with such entries in the data.
g. ***Business Continuity plans*** – A business continuity plan is a process of documenting the response of the organization to any incidents that cause unavailability of whole or part of a business-critical process.

CONCLUSION

The companies which are trying their best to attract more and more customers should plan and implement strategies after studying the customer behavior keenly. It will help the companies to attract more customers. Studying customer behavior and classifying them based on their interests and using this data for planning strategies will boost the company's profit by gaining more customers. Machine Learning algorithms help in understanding customer behavior and recommending the best offers to their customers. Collecting required data, and exploring and understanding it thoroughly helps in recommending the best offers to the customers. The collaborative filtering method used for recommendation works fine in personalized marketing. With the help of the proper use of available technologies, companies can reach customers using social media and attract them with suitable offers concerning their choices and preferences.

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Iot Based Healthcare Monitoring System

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Abstract. The fitness tracker can measure oxygen saturation, heart rate, blood pressure, and temperature. With the help of the Internet of Things, a new era for medicine has begun. A health tracker based on IoT is used in this proposal to measure factors. In addition, it is quite useful for displaying and saving data. Through the Internet of Things, all resources can be easily connected and quality of life can be enhanced. Whenever an irregularity occurs, users will receive email or SMS notifications from this IoT-based healthcare tracking system. Using the Internet of Things, doctors can also access and save data to read on their mobile devices. Using the Internet of Things, doctors can obtain information that is useful to them and allow them to make quick decisions.

INTRODUCTION

The body's temperature and pulse have a significant influence on one's health. Using IoT-based health monitoring systems, people can check their heart rate, blood pressure, body temperature, and oxygen saturation. Values are determined through sensors. The LCD display is connected to the sensor by a microprocessor. With the advancement of medical science, the great tragedy caused by the corona virus can be avoided. In the event of an emergency, emails are sent to doctors and patients. Health always comes first in any growth. Utilizing remote monitoring technologies to keep an eye on patient health makes sense. This issue might be resolved by implementing an IoT health monitoring platform. Priority is given to the happiness of the people. Serious illnesses are treated with excessive hospitalizations. This should be considered, particularly if an outbreak occurs in an area where medical personnel are at risk. Using intelligent sensors to halt the spread of disease is an effective approach to save lives.

RELATED WORK

In 2017, Niket Patil and his associates created an Internet of Things (IoT)-based system to monitor the physical activity and captures of soldiers. Patil advises employing LM35 sensors, heart rate monitors, and spot oxygen sensor devices for monitoring. According to Patil, the system's Node MCU ESP 8266 WiFi module connects to the internet, and the highly accurate SIM28M GPS is used to track the soldiers. There is also a panic button that you can use to summon assistance in an emergency. The system is relatively affordable and the sensors are coupled to an MCU board called Arduino Uno (ATMega 328p).

Naina Gupta et al. suggested a way for transmitting data using a GSM module connected via Bluetooth to cut down on unnecessary time in both inpatient and outpatient settings. Tracking various physiological variables and doing routine health checks are the major goals of using several sensors linked to the body. They concentrated on creating a small mobile phone with GPRS capabilities for sending data to secure networks. Uddin et al. (2012) proposal, a real-time monitoring system that is helpful in intensive care units was created. The data is assembled by this system using an Arduino Uno and body sensors before being sent to the application. This tool assists in keeping track of numerous variables that fall inside a specific range and degree of connectedness.It offers a range of IoT protocol and IoT cloud-based application-specific data transfer techniques.

This Internet of Things (IoT)-based method was suggested by Zia Uddin Ahmed and colleagues in 2019 to use wearable biomedical equipment to monitor patient health. The system has sensors connected to a microcontroller and her GSM module to warn the user or her family in case of an emergency. There are numerous hardware parts of this

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system that are directly attached to the patient. Additionally, clients may find this information from a variety of sources due to the fact that it is dispersed throughout numerous businesses.

Chowdhury and others Al (2011) proposed a system that connected a GSM module to a Raspberry Pi and contained a variety of different health monitoring sensors. They sought to make patient monitoring portable so that hospitals wouldn't have to worry about it. In order to update the new values and store the data in the system, a read speed of 20 seconds was attained.

Piyush Maheshwari, Amit Agarwal, and Sapna Tyagi created the concept of the Internet of Things (IOT) (2016).
If all of these can be connected to the appropriate information and communication technologies, technological revolutions are anticipated in the fields of logistics, smart homes, care, and cargo surveillance. The fundamental elements and features that distinguish each IOT application are included in this post's description of IOT apps.

IoT-Based Intelligent Health Platform (2016), an Internet of Things-based health monitoring system for emergency medical services is designed and implemented in this article. The system makes use of Intel's 2nd generation galileo development board to show how IoT data may be dynamically gathered, integrated, and disseminated to support emergency medical services like nursing units. In order to reduce healthcare expenses and improve health risks, the suggested approach enables users to effectively gather, record, analyze, and share enormous data streams in real-time.

IOT BASED HEALTHCARE MONITORING SYSTEM

As a result of the discovery of the Corona virus, healthcare has gained tremendous importance around the world. An IoT-based health monitoring system is therefore the ideal way to contain an outbreak of this nature. An emerging field of study called the Internet of Things (IoT) is revolutionizing the Internet, particularly in healthcare.

ARDUINO UNO

The Arduino Uno microcontroller board is built on the ATmega328 (datasheet) as shown in figure 1. It contains a 16MHz ceramic resonator, a USB connector, a power jack, an ICSP button for connection, a reset button, and 14 digital input/output pins, six of which can be used as PWM outputs. It includes all the components required to support the microcontroller. It attaches a USB cable, AC-DC converter, or battery to a power source to begin using it. Due to the fact that it does not utilize the FTDI USB serial controller chip, the Uno differs from all previous cards. Atmega16U2 chips (Atmega8U2 versions up to R2) that support USB-serial are used.3.2. LCD.

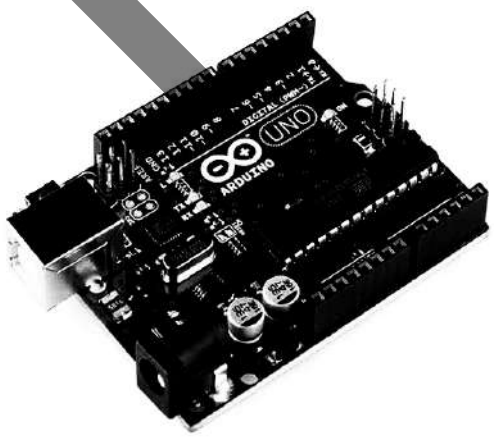

FIGURE 1: Arduino UNO Board

LCD

The main operating system for LCD is Liquid Crystal Display. Solid or liquid materials are used to create LCD panels as shown in figure 2. Liquid crystals are used to produce the images that may be viewed on an LCD monitor. A lot thinner displays are available with LCD technology than with cathode ray tube (CRT) technology.

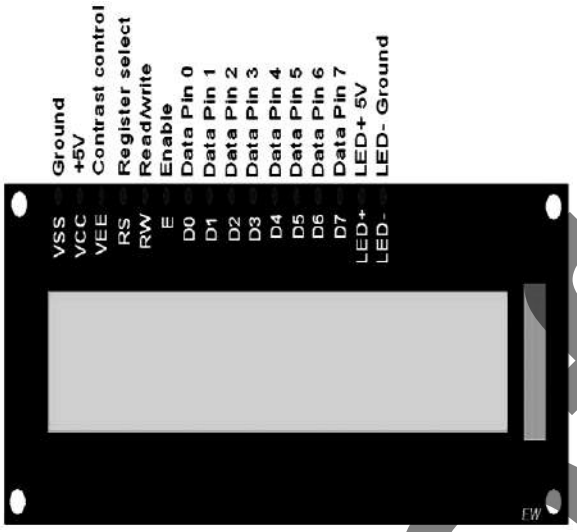

FIGURE 2: LCD

MAX30100 SENSOR

The MAX30100 is a sensor that can gauge both heart rate and pulse oxygen saturation. It has twin LEDs, photodetectors, enhanced optics, pulse oximetry, and heart rate signal detection, as well as low-noise analogue data processing. Software can be used to provide the MAX30100 with a relatively low standby current, enabling it to continue receiving AC power. Compatible with both 1.8V and 3.3V sources as shown in Figure 3.

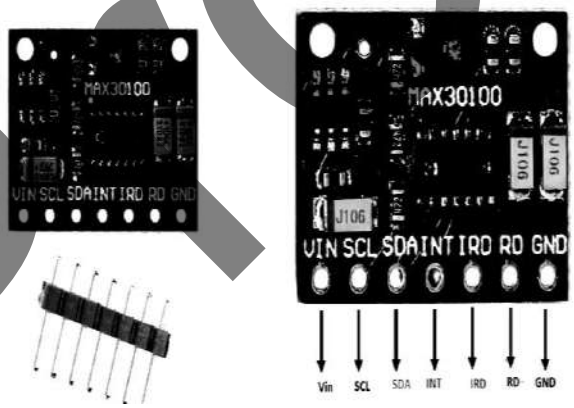

FIGURE 3: MAX30100 SENSOR

METHODOLOGY

People are totally ignorant of their circumstances when their oxygen levels are low. Most people don't have the time or money to go to a doctor for testing. Going to the hospital is challenging for elderly persons in wheelchairs and people with limited mobility. Patients can check their blood oxygen levels and make sure their cardiac rhythms are normal using the proposed system at home. We have created several devices, including the MAX30100 sensor, the BMP180 sensor, the WiFi module, and the LCD display. The MAX30100 sensor is used to detect heart rate and oxygen saturation in this instance. The BMP180 sensor measures both blood pressure and temperature. A microcontroller that has been programmed turns on the sensor and communicates with the LCD screen.

According to Figure 4, when the people touch the sensor, the sensor responds and displays the reading. The text that appears on the screen is based on the Arduino code. In addition, it transmits data to the server via an ESP8266 WiFi module. The suggested application receives data that has been stored in the cloud. It may view and store data using the app on your mobile device. The patient receives a message outlining the emergency.

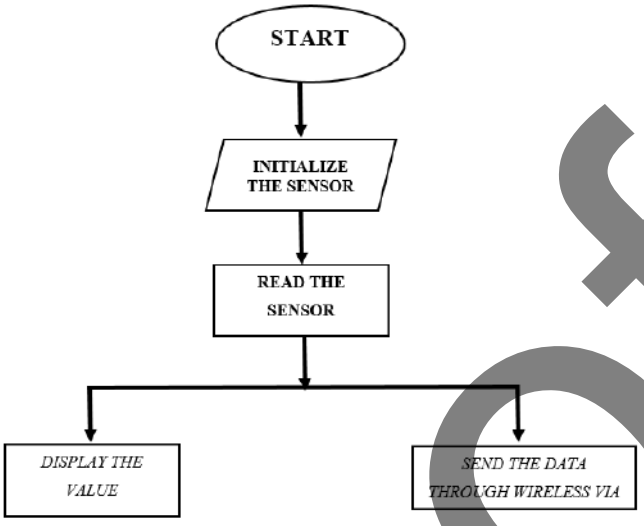

FIGURE 4 Sensor Initialization

Figure.5 illustrates the block diagram of the suggested methodology. There are distinct sections in the arduino code and the wifi module. The Arduino UNO board is receiving power. The analogue pins on the Arduino board are used to connect the MAX30100 and BMP180 sensors. Input pins are supported by this analogue pin. There are 6 analogue pins on the Arduino board. After the finger has been positioned, the sensor will read the value. These numbers are shown on the LCD. In this instance, her WLAN module is used to transmit the data to the server (ESP8266 MODULE).

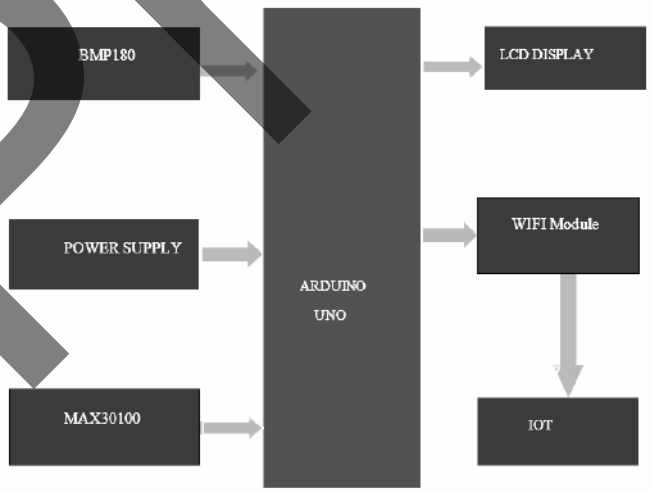

Figure 5: Block Diagram

RESULT AND ANALYSIS

In this proposal, Arduino to analyze blood pressure, temperature and oxygen saturation level is used. It can display and store data in an application using an IoT-based healthcare tracking system. Doctors can identify patients' heart

problems through this program. The data is transferred to the server using the wifi module. The Arduino UNO board is provided as a power source as shown in figure 6. The analog pin on the Arduino board is where the MAX30100 and BMP180 sensors are connected. An input pin for this analog device is used. The sensors read the values as soon as the finger is positioned. The values will be displayed on the LCD screen as illustrated in figure 6. In this case, the data is transferred to the server using the wifi module (ESP8266 MODULE) and Figure 7 indicates the mail notification for the health monitoring system.

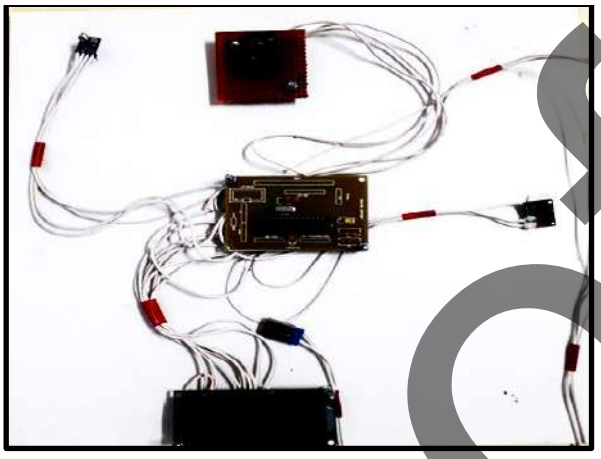

Figure 6: Hardware Implementation

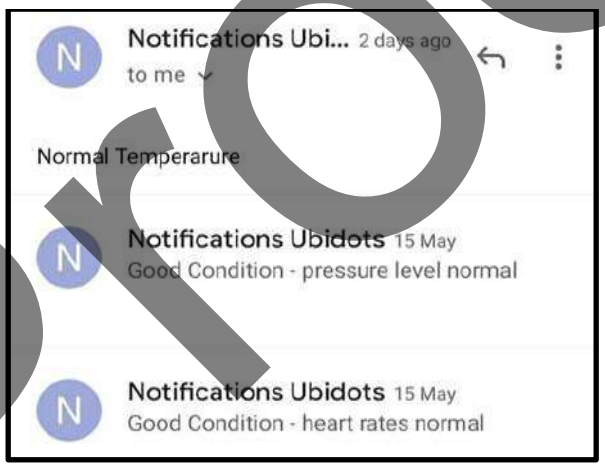

FIGURE 7: Mail Notification

CONCLUSION

In this study, IoT-based health monitoring systems are examined. Using an Arduino UNO, a sensor was used to calculate the heart rate and temperature of the patient, and update the database. It is now possible for doctors to access data using IoT. Patients' blood pressure, heart rates, oxygen levels, and heart rates are monitored by the device using specific sensors. By utilizing our solutions, doctors can save their patients from significant life loss by taking action at the right time.

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Cyberbullying Detection on Social Networking Sites Using BERT Transformer

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Abstract. Technological advancements have increased the amount of people using online social networking sites, which has led to an increase in cyberbullying. Online Social Networking sites provide a vast network for bullies to attack victims. Cyberbullying is a catch-all phrase for a wide range of online abuse, including but not limited to harassment, doxing and reputation assaults. These attacks often leave permanent mental scar(s) on the victim(s), which leads to drastic measures like depression, self-harm and suicidal thoughts. Given the consequences of cyberbullying, there is a dire need to take action against such crimes and to prevent them. This paper proposes a novel architecture to efficiently detect cyberbullying pattern. The proposed architecture utilizes the pre-trained model BERT to detect cyberbullying behavior on online platforms. The proposed models were tested on dataset taken from Kaggle and achieved accuracy of 80 percent. This paper provides a thorough examination of the various methodologies used for cyberbullying detection.

INTRODUCTION

The prevalence of social media is increasing exponentially as the technology advances. Popular social networking platforms like Twitter, Facebook and Instagram are being utilized to connect in real-time worldwide. The rapid dissemination of negative information and status updates via these social networks can have a detrimental effect on users, encouraging cybercrimes like cyberbullying. Despite the fact that the phrase "cyberbullying" is extremely broad, there is still no consensus on what it actually entails. Figure 1 illustrates how perpetrators of cyberbullying create a sort of record of their victims' opinions, actions, and decisions by sharing harmful, offensive, or threatening content. Flooding, exclusion, harassment, outing/doxing, cyberstalking, deception, trolling, impersonating, and denigration are hidden forms of cyberbullying [1], and can damage an individual's reputation, cause a victim to withdraw from public life online and in real life, affect their mental health, and ultimately lead to increased risk. Considering the consequences, it is imperative to be vigilant regarding online content.

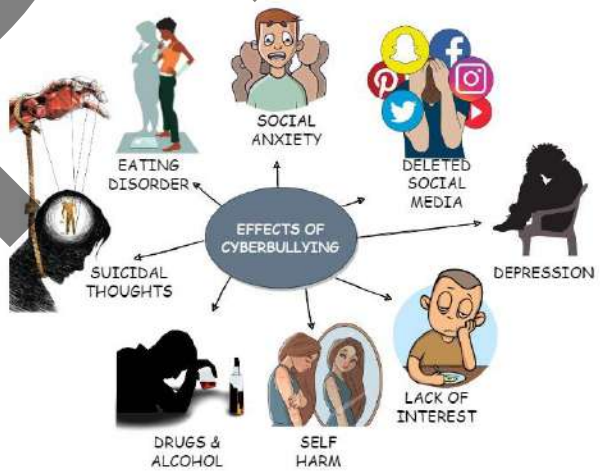

FIGURE 1. Victim's mental state caused by cyberbullying.

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Machine learning techniques are used by the majority of cyberbullying detection systems. Huge data sets have a limited capacity, which prevents traditional machine learning algorithms from producing results with high accuracy. One of the most prominent methods for improving cyberbullying detection is feature engineering. Researchers in this subject employ n-gram analysis, social information gathering from user's network, performing sentiment analysis and word embedding generation. To automate the task of feature extraction, recurrent neural network (RNN) and one-dimension convolution neural network (CNN) are among the primary methods for text classification.

This work aims to effectively identify cyberbullying on social networks, with the ultimate goal of proposing a transformer-based model to efficiently detect bullies' linguistic patterns and presenting a comprehensive review and carrying out a comparative analysis of the proposed model with various methodologies.

This work is structured into the following sections: Section II involves a discussion about the related works, Section III elaborates the proposed methodology, Section IV analyzes the observational evidence and evaluates the proposed strategy, and Section V concludes the paper.

RELATED WORKS

The automatic identification of cyberbullying on social media has received considerable interest from the literary world. The early works of Agarwal et al [2]. investigated Twitter sentiment analysis and developed a model for two classification tasks: 1) Positive vs negative binary 2) Three categories: good, negative, or neutral. For incorporating several feature categories in one clear, practical representation, they created a tree-like representation of tweets. The combination of unigram with senti-feature model outperforms their tree kernel-based model with unigram baseline by over 4%. The same year, Qianjia et al. [3] investigated the usefulness of social information in the detection of cyberbullying using linguistic features. They employed a thorough technique. Analysis was performed on the Twitter corpus, from the CAW 2.0 data collection, which consists of 900,000 posts from 27135 users. For a balanced training dataset, the "SMOTE" (Synthetic Minority Oversampling Technique) is applied. In order to work, SMOTE oversamples the minority and undersamples the majority. The research's main objective is to look into the social as well as the linguistic components of cyber-conversation; demographic variables cannot be looked at because the data is from Twitter.

Building on the work of Qianjia et al. [3], Singh et al. [4] provide a probabilistic information fusion paradigm based on confidence ratings and interdependencies associated with numerous social and textual characteristics. In an early fusion approach, each feature is examined separately, and the confidence levels of the features are not distinguished. The "late fusion" method achieves 89% accuracy compared to the "early fusion" method's 76% accuracy by modeling the confidence score for each modality using a-priori instances of the training data.

A machine learning model may take hours to train when given complex data. According to Mangaonkar et al. [5], tweets should be distributed among the participants for group analysis. Based on the application of various machine learning algorithms, tweets can be classified as non-cyberbullying or cyberbullying by making use of the collaborative paradigm. 7 out of 15 situations that used cooperation strategies outperformed their sequential equivalents. It was not necessary to tune the algorithms much to achieve these results. Consequently, if the collaborative techniques can produce results as good as the sequential approach, then it is worthwhile to use them since they are more time-efficient.

It is possible to learn more accurate and discrete text representation techniques by using the underpinning structure of information on bullying. Based on comprehensive tests performed on two public cyberbullying corpora, Zhao et al. [6] hypotheses exceed baseline text representation learning techniques (Twitter and MySpace). The second use of word embeddings is expanding and streamlining domain-specific word lists relevant to bullying. Two social media cyberbullying corpora from Twitter and MySpace, with accuracy rates of 84.9% and 89.7%, respectively, have been utilized to experimentally validate the effectiveness of their techniques.

Although other languages are widely utilized on online social networking sites, research has mostly concentrated on English-language content. Deep Neural Network was used by Ahmed et al. [7] to identify bullying expressions on the Bengali version of Facebook, proposed a binary and multiclass classification models to classify bully expression. On public Facebook pages, 44,001 comments were included in the dataset. 85% of the multiclass classification model's predictions are accurate, compared to the accuracy of the binary classification model which is 87.91%. The model's drawback for the paper was that it needed more training time and had false-positive findings for longer words. By analysing the written content with Sentiment Analysis and using a machine learning approach, Almutiry et al. [8] proposed a method for detecting offensive/abusive tweets in the Arabic language and labelled the tweets as "Cyberbullying" and "Non-Cyberbullying." Their research intended to identify cyberbullying using a time limit. The accuracy is 85.49 using Light Stemming with WEKA, and the needed time is 352.25 seconds. While Python takes 142.68 seconds and has an accuracy of 84.03, ArabicStemmerKhoja with WEKA requires 212.12 seconds and has an accuracy of 85.38.

Personal attacks and hateful language on Twitter and Wikipedia were two significant forms of cyberbullying that Jain et al. [9] identified and classified using Natural Language Processing (NLP) and Machine Learning Algorithms. Using three feature extraction approaches (Word2Vec, Bag of Words and TF-IDF) and four classifiers, the model achieves 90% accuracy for Twitter data and 80% accuracy for Wikipedia data (Logistic Regression, Support Vector Machine, Random Forest, Multilayered Perceptron).

TABLE 1. Comparative analysis of, dataset used, features used, methodologies employed, performance metrics and limitation/remark of different researches are tabulated

Author's Name/ Year	Dataset	Methodology	Features Used	Classification	Performance metrics (In percentage)	Limitation/ Remark
Md Faisal Ahmed, 2021[7]	Facebook	A hybrid neural network is used to create a binary and multiclass classification model.	Word Embedding	LSTM	binary classification Accuracy = 87.91 Multiclass classification Accuracy = 85	For relatively long texts, binary and multiclass classification models needed additional training time and occasionally provided false positive results.
Agarwal A, 2011[2]	Twitter	Designed a tree kernel-based model with two classification tasks using sentiment analysis and compared with unigram + senti-feature model.	Polar POS tagging, Non-polar POS tagging	Unigram, tree kernel, Senti-features, unigram+Senti-features, and tree kernel+senti-features	Accuracy = 75.39	Unigrams had a significant disadvantage with minimal training data, although both the tree kernel and the suggested unigram model performed well.
Almutiry S, 2021 [8]	Twitter	Sentiment analysis for analyzing, SVM classifier on both WEKA with Light Stemmer and ArabicStemmerKhoja	Textual, TF-IDF	SVM	WEKA- Light Stemmer: 85.49 WEKA-ArabicStemmerKhoja: 85.38 Python: 84.03	The WEKA proved to be more reliable in classifying the text correctly, however, Python resulted in being more effective with time to build the model.
Amrita Mangaonkar, Allenoush Hayrapetian, 2015 [5]	Twitter	A collaborative methodology for classifying a tweet as "bullying" or "non-bullying" using ML algorithms.	WordTokenizer, Bi-GramTokenizer	Naive Bayes, SVM, Logistic Regression	Balanced dataset: Accuracy = 60 Imbalanced dataset: Naïve Bayes: Accuracy = <60	When one server performs the proper classification, its results are washed out by the other servers, resulting in more false negatives and a lower recall in AND parallelism.
Qianjia Huang, 2014[3]	Twitter	J48, Bagging and Dagging, Naïve Bayes, SMO and Information Gain methods are used for classification.	Social, Textual	Bagging, J48, SMO, Dagging, Naive Bayes, ZeroR	Accuracy = 76	Demographic considerations, more sophisticated characteristics, and textual analysis could not be incorporated in this technique.

Varun Jain, 2021[9]	Twitter Wikipedia	Natural Language Processing, Machine learning, BoW and Tf-Idf models	TF-IDF, Bag of Words and Word2Vec.	SVM, Logistic Regression, Random Forest, Multi Layered Perceptron	Twitter data: Accuracy = 90 Wikipedia data: Accuracy = 80	The study involved a combination of NLP and ML algorithms to detect and categorize into cyberbullying and hate speech.
Zhao, 2017[6]	Twitter, MySpace	The popular deep learning model stacking denoising autoencoder has a semantic expansion	BWM, BoW, Semantic c-enhanced BoW, LSA, LDA	mSDA, smSDA and smSDAu	Twitter: Accuracy = 84.9 Myspace: Accuracy - 89.7	The results were achieved with a single layer design and no nonlinear activation. SmSDA reconstructed words were more similar to bullying terms than mSDA reconstructed words.

METHODOLOGY

DATASET DESCRIPTION

Data available on Online networking sites are confidential and sometimes users of social media are reluctant to share information. The data gathering is one of the biggest hurdles to cyberbullying detection. The identification of cyberbullying does not employ standardized datasets. The great majority of research uses scraped websites, open APIs, or pre-existing datasets from Kaggle, Formspring, etc. to evaluate data from the same social networks (such as Twitter and YouTube). Because of this, data comparisons are difficult. The original datasets have a considerable imbalance, with the majority of studies using datasets with less than 20% of the results generated during the testing as cyberbullying. This imbalance offers a hurdle since it has been well proven to impact the prediction capacities of several machine learning classifiers [10]. Because cyberbullying is an inherently unbalanced phenomenon, synthetic oversampling or under sampling approaches have been employed in a number of studies [3, 11, 12] to produce more balanced datasets, which have been claimed to improve classification.

In order to conduct this experiment, the dataset is taken from Kaggle consisting of 47693 tweets in total and are labeled based on Age, Ethnicity, Gender, Religion and other types of cyberbullying. The dataset has been balanced in order to contain ~8000 of each class. Figure 2 shows the statistics of the balanced dataset used.

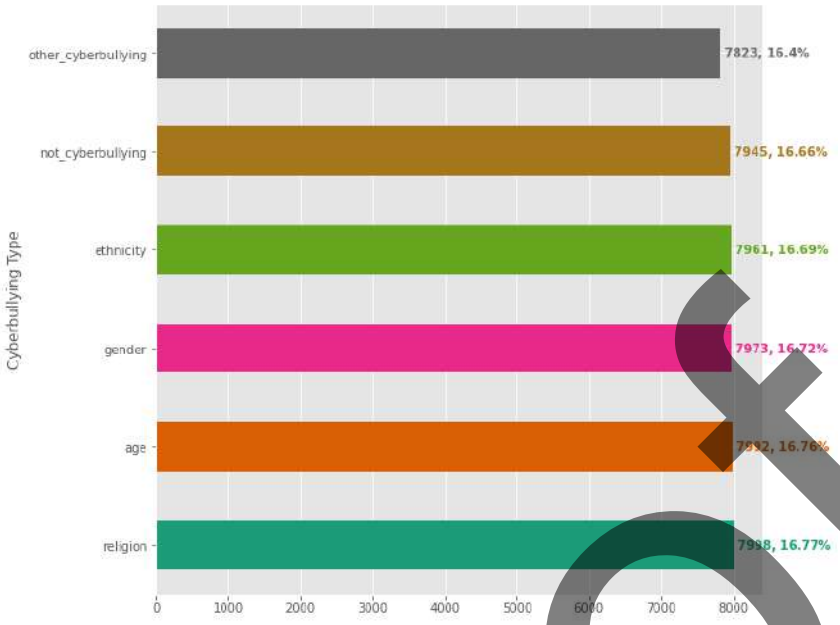

FIGURE 2. Dataset Statistics.

TEXT PREPROCESSING

Figure 3. shows the data processing pipeline used before classification, tweets are first converted to lowercase. The following procedures are used to preprocess data utilizing natural language processing (NLP) and twitter to remove noise from the textual content of the dataset. Using the preprocessor library of tweet preprocessor, special characters (&, +, /, %), numbers, single characters, user mentions (@user), tags, links, whitespace, duplicate tweets, retweets, and tweet pictures are all eliminated.

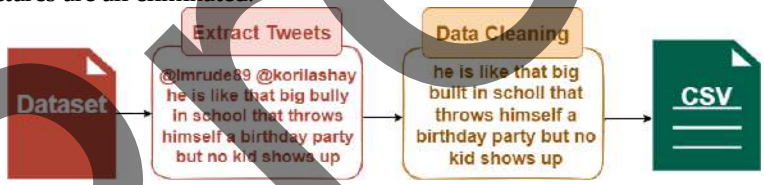

FIGURE 3. Data preprocessing.

PROPOSED MODEL

A transformer refers to a deep learning model that makes use of the self-attention technique to weigh each input variable depending on its relevance. It is commonly used in natural language processing (NLP) and computer vision (CV).

Representations of Bidirectional Encoder from a Transformer or BERT [13] has demonstrated to be an extremely effective linguistic model that can be utilized to address variety of problems with natural language, including text classification and sentiment analysis. Though, there is a limitation to the original BERT, and that is that it relates to its size. BERT employs a transformer that discovers contextual relationships between words in a text/sentence and generates contextualized word embedding.

Language models frequently translate the input sequence either from left to right or from right to left. This one-directional training works well when the objective is to predict or generate the next word. BERT employs bidirectional training to improve comprehension of linguistic context. It is also referred to as "non-directional." As a result, it encompasses both the prior and successive tokens.

The proposed BERT model has two mechanisms: preprocessor and encoder. Figure 4 shows the architecture of BERT model.

- Preprocessor: Before passing the raw data (a tweet) to the model, the preprocessor transforms it and generated embedding vectors. Making masks, inserting tokens, and assigning ids are all preprocessor tasks.
- Encoder: The encoder creates encoding for each word, phrase, and input as a whole. The BERT encoder implements the basic version of the BERT network, which is made up of 12 consecutive transformer layers with 12 attention heads each. Every token in the input of the block is embedded in a 768-long learned embedding vector.

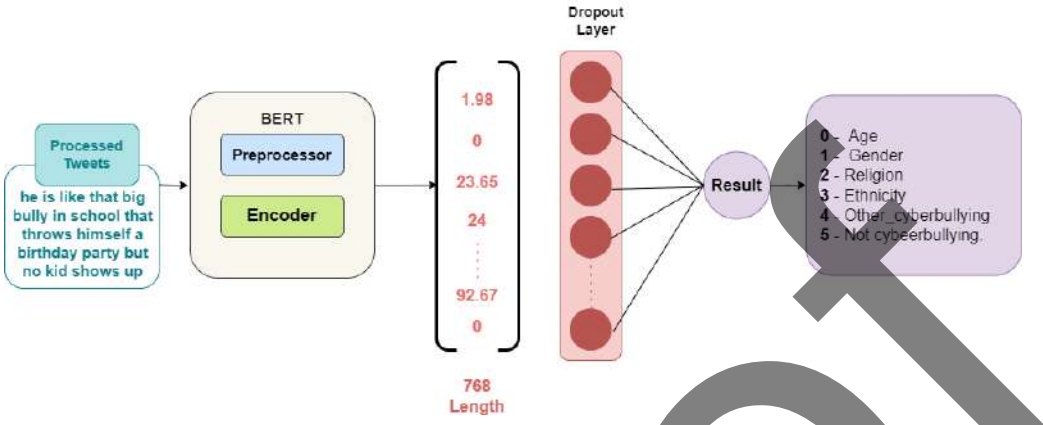

FIGURE 4. Architecture of the proposed BERT model.

EXPERIMENTS AND RESULTS

TRAINING SETUP

For this experimentation process, Keras is employed in the Google Colaboratory environment using GPU. The dataset was split, using 70% of the data for training and 30% for testing, by applying the train_test_split method from sklearn.model_selection. Splitting was done randomly such that the training data had an approximately equal proportion of cyberbullying and non_cyberbullying tweets. Pre-trained preprocessor and encoder model was downloaded and model structured was defined. Figure 5 displays the synopsis of the proposed model.

```
Model: "model"
_________________________________________________________________________________________________
 Layer (type)                Output Shape              Param #     Connected to
=================================================================================================
 clean_tweet (InputLayer)    [(None,)]                 0           []

 keras_layer (KerasLayer)    {'input_word_ids':        0           ['clean_tweet[0][0]']
                              (None, 128),
                              'input_mask': (Non
                             e, 128),
                              'input_type_ids':
                             (None, 128)}

 keras_layer_1 (KerasLayer)  {'pooled_output': (       470926849   ['keras_layer[0][0]',
                             None, 768),                            'keras_layer[0][1]',
                              'sequence_output':                    'keras_layer[0][2]']
                              (None, 128, 768),
                              'default': (None,
                             768)}

 dropout (Dropout)           (None, 768)               0           ['keras_layer_1[0][1]']

 output (Dense)              (None, 6)                 4614        ['dropout[0][0]']

=================================================================================================
Total params: 470,931,463
Trainable params: 4,614
Non-trainable params: 470,926,849
_________________________________________________________________________________________________
```

FIGURE 5. Synopsis of proposed model

EVALUATION RESULTS

After defining the model's structure, model was trained for 30 epochs, but Early Stopping callback was used to monitor the validation loss during training, the training was interrupted at 13 epoch, as the model's metrics was not improving for last 4 epochs, the weights from the epoch where the validation loss showed the lowest value are restored using restore_best_weights = True. Figure 6 showes the values of each metrics monitored during training, and compares the training and validation curves.

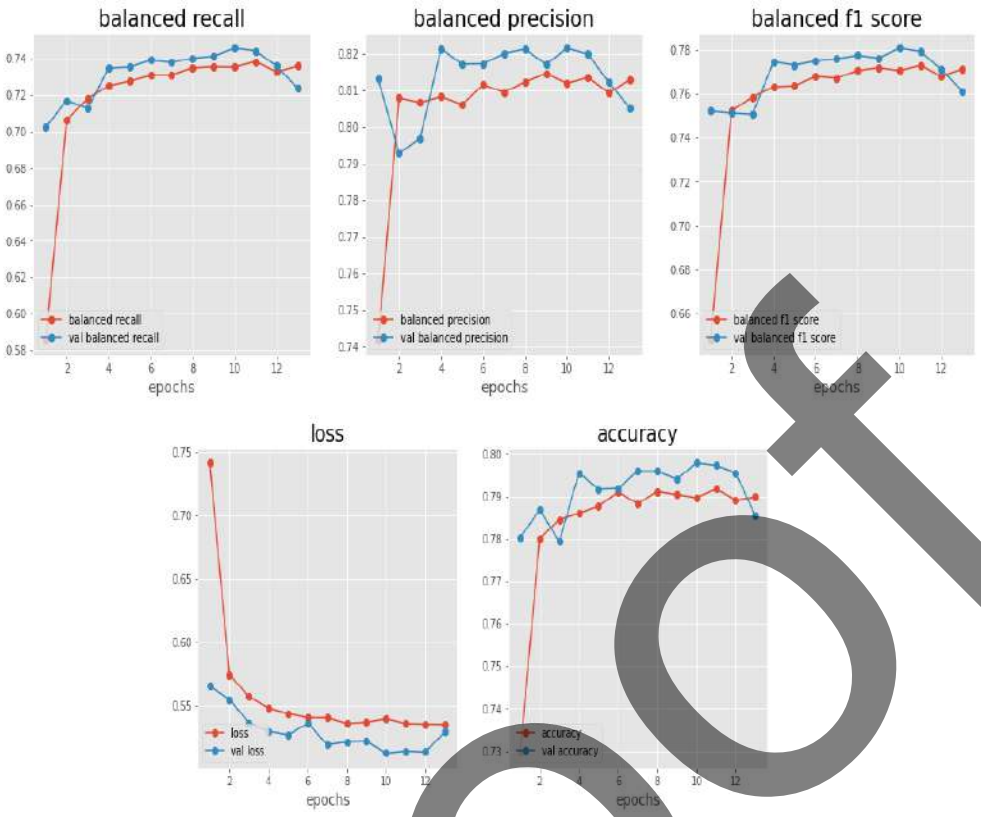

FIGURE 6. Training and validation curves of each performance metrics

Figure 7 displays the confusion matrix of 6 classes. The heatmap depicts the proportion of the instances that are accurately classified. Each cell also includes a report of the raw data. It is noted that "other_cyberbullying" and "not_cyberbullying" class is the most difficult to classify and is frequently mistaken with the "not_cyberbullying" and "other_cyberbullying" class respectively. One key reason could be the data labeled as "other_cyberbullying" might not actually fall into the class of bullying when looking at it from different perspectives, and the data labeled as "not_cyberbullying" might come under bullying.

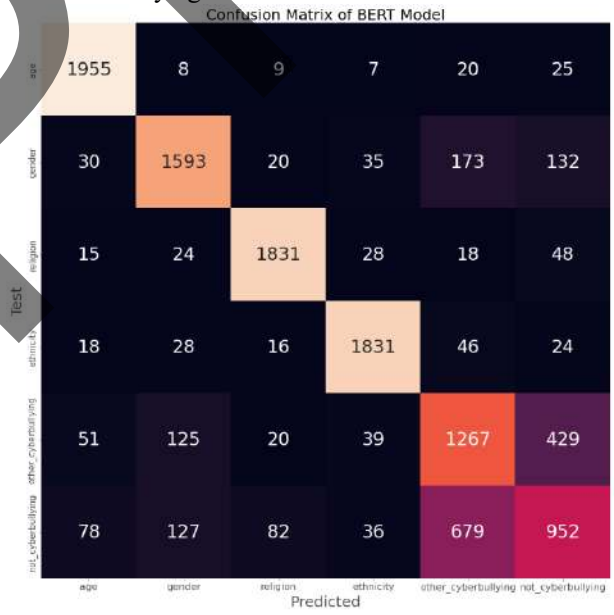

FIGURE 7. Confusion metrics.

Table 2 displays the precision, recall and f1-score (harmonic mean of precision and recall), broken down by class.

TABLE 2. Classification report broken down by class.

	Precision	Recall	F1-score
Age	0.91	0.97	0.94
Gender	0.84	0.80	0.82
Religion	0.93	0.93	0.93
Ethnicity	0.93	0.93	0.93
Other cyberbullying	0.58	0.66	0.61
Not cyberbullying	0.59	0.49	0.53

ERROR ANALYSIS

To undertake error analysis, after manually checking cases that were erroneously categorized. Certain posts/comments contain objectionable language and are likely to appear in other categories.

Some words are offensive in nature but are frequently used in other contexts and might not be offensive to some (Refer Table 3). Few possible reasons behind these misclassifications can be:

- Presence of offensive language.
- The existence of multilingual words that our suggested model is unable to translate.

TABLE 3. Instances and the reason behind the misclassification.

Instances	Predicted	Original	Reason
@nierneft: we should do a challenge where everyone turns off the autocorrect for their smartphone let's see how retarded people are	Other cyberbullying	Not cyberbullying	Use of "retarded people" phrase. (Insulting others)
@CarSalesBossMan Unlike men, who can't fix cars because they can't fit their giant swelled heads under them.	Other cyberbullying	Not cyberbullying	Sarcastic phrase directed towards people who are not identified as "men".

CONCLUSION

With the alarming rates of cybercrime, it is imperative to prevent them online. It is essential to increase awareness of the growing incidence of cyberbullying involving locals and celebrities and to prevent it. This work introduced a novel framework to detect bullying instances on online social network through transformer-based learning using the BERT model. The performance of the BERT transformer has been measured using score accuracy, confusion matrix, and classification reports including precision, recall and F1- score. The analysis of the BERT model-based text mining technique shows the accuracy of 80%.

For this experimentation process, only contextual features of the content present on online social networking are considered. In the future, images, videos, audios, and URLs attached in the posts can be utilized for classification along with textual analysis in order to detect cyberbullying effectively. Other challenges encountered throughout the experimental phase will also be identified in the future.

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Metaverse: Democratization of reality E-Commerce using AR and VR

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Abstract. Metaverse is a popular trend in the development of the Internet and the next mega phase of the Internet after the global pandemic. Metaverse is a socio-technical system aimed at providing users with real-world, immersive, and synchronous 3D experiences through an interoperable, persistent multi-user platform. It will allow people to interact seamlessly, work, learn, and shop. It is a virtual space where you can have autonomous and persistent shared spaces that enable multi-sensory interactions with augmented reality. This research paper presents a comprehensive architecture that examines the latest metaverse developments in terms of cutting-edge technology and the metaverse ecosystem, demonstrating the potential of the "big boom" of the world wide web. This work gives insights of modern technologies used in the metaverse - Mixed Reality, AR, and VR and discusses the democratization of e-commerce with AR/VR and also scenario of how many companies is coming up with new digitally-enabled selling concepts by integrating the metaverse to upscale their business. This study views metaverse as a phenomenon involving relevant business opportunities in online shopping and presents our theoretical consideration of this overarching concept.

INTRODUCTION

Metaverse can be explained as an immersive web 3.0 dimensional digital world that can be expounded as an augmented universe, a persistent and incessant that is simulated using blockchain, augmented reality, and virtual reality, known as AR and VR, respectively. A speculative factitious environment with an enriching user interface (UI - UX), and interaction imitating the real world that integrates physical reality and digital virtually. Neal Stephenson, in 1992, originated the concept of the Metaverse in his novel “Snow Crash" [3]. In this he portrayed the realistic avatars who encountered each other in 3D virtual buildings and several other virtual reality environments. It got massive recognition in October 2021, when Mark Zuckerberg, the CEO of Facebook, declared that Facebook would be renamed as “Meta," that would make noteworthy macroeconomic investments in the field of Metaverse. The proliferation of the metaverse in e-commerce market share has been predicted to be $ 60.47 billion from the years 2021 to 2026, at a Compound Annual Growth Rate (CAGR) of 36.47% [4]. Currently, innumerable experts are operating on various cryptocurrencies to establish a cybernated economy within these virtual reality worlds. Crypto blockchains constitute a completely attainable digital economy with the convenience of a high level of security for currency because of the fact that they have decentralized management. The future metaverse will be indistinguishable from our real world and will even replace real-world activities in so many aspects. With the SARS-CoV-2-virus, the Covid-19 pandemic was a brutal turning point for humanity, industry, and the economy of the world. Millions of individuals were exposed to acute hunger and penury, and millions of businesses faced an existential crisis as a result of the pandemic's enormous social and economic disruption. Around 3.3 billion workspaces around the world were in danger of going out of business. Additionally, by the end of the year, the anticipated 690 million individuals who are malnourished might increase to 132 million. But there are a few good things that came out of it as well. There is an unexpected rise in the adoption of digital technologies during the pandemic than we could have ever imagined. The pandemic also brought the Work from Home system (WFH), where workers do not need to physically travel to corporate offices to work but instead, utilize their job at home, office, car, etc. through an internet connection. According to a KPMG study conducted in July, 64% of respondents "want the freedom to work remotely," while 59% said they "prefer to work primarily in the office or on-site" [5]. Technologies like AR, VR, and Blockchain carry enormous potential to overcome umpteen of the challenges that are brought by the pandemic. Companies assiduously used VR platforms during lockdown, this is one of the reasons why virtual reality attained immense popularity, helping

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members from different teams to join each other in a virtual environment. This work showed an e-commerce platform in the metaverse using various stacks and technologies. The focus of this research is to uplift perceptions about the topic, which in turn maps out a unified vision for the metaverse. In the next section, we will discuss the infrastructure and development of the metaverse.

ARCHITECTURE AND FRAMEWORK OF METAVERSE

INFRASTRUCTURE OF THE METAVERSE

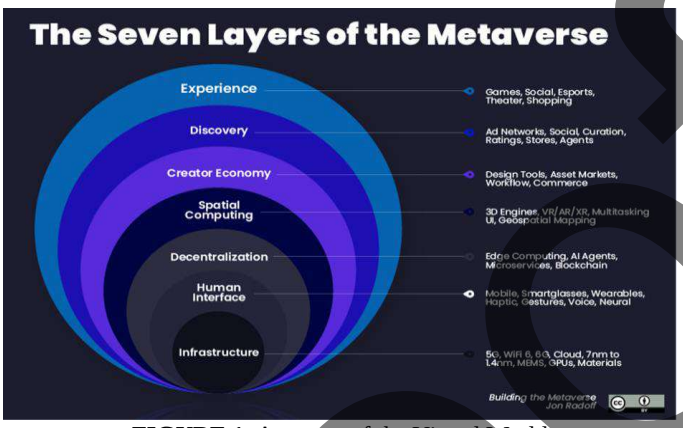


FIGURE 1. Anatomy of the Virtual World

In the above figure, the research analysis focuses on the groundwork of the metaverse, which comprises seven prominent layers.

INFRASTRUCTURE

Empowering the devices with the technologies, allowing them to join an online network, and eventually provide the essential information to make up the first stage of the Metaverse's development. In the absence of internet technologies like 5G and Wi-Fi, virtual worlds cannot be connected. Additionally, the cloud and its computing resources are crucial elements of the infrastructure needed to construct the Metaverse.

HUMAN INTERFACE

Digital Human Interface Metaverse The term "human user interface" (HUI) refers to the hardware that enables us to access the metaverse. Examples of such gear include mobile devices, virtual reality headsets, and smart glasses. Human beings are becoming cyborgs as computing gadgets get ever-closer to them, no longer considered phones, smartphones. They are the most powerful, constantly connected, and portable PCs with a pre-installed mobile phone application. They are only going to get stronger, and they will be able to support more applications and metaverse experiences with further downsizing, the right sensors, integrated artificial intelligence, and low-latency connectivity to strong edge computer systems. An expanding business is experimenting with novel approaches to bring people closer to the machines: Future technologies include miniaturized biosensors that can be printed on the skin and 3D-printed wearables that are integrated into both fashion and apparel. Consumer neural interfaces can also be made possible in the metaverse.

DECENTRALIZATION

Decentralization is about moving the entire ecosystem to a permissionless, more democratized structure. A complete overview of the Metaverse is the exact opposite of its current leader, ruled by a single entity. Experimentation and progress will increase dramatically as opportunities expand, and systems become interoperable and built within a

highly competitive marketplace where manufacturers dominate both data and creations. Distributed computing and microservices are a highly scalable ecosystem that allows developers to take advantage of online capabilities such as trading systems, specialized artificial intelligence, and various gaming systems without having to focus on building and integrating backend functionality. Blockchain technology liberates financial assets from centralized management and custody of decentralized finance. The emergence of non-fungible tokens, as well as blockchains optimized for the types of microtransactions required for gaming and metaverse experiences, will bring a wave of invention to decentralized markets and applications for gaming assets. Far-edge computing brings the cloud closer to people's homes, enabling robust, low-latency applications without overwhelming devices with all their work. Processing power is comparable to utility companies, not data centers.

SPATIAL COMPUTING

The creation of a 3D depiction of another universe would be the Metaverse. Advanced 3D visualization and models that the 3D worlds may be constructed upon are requirement in development. The subject's body was carefully targeted by a spatial AR representation. The concept behind spatial computing is the breaking down of the partition between the actual and ideal worlds through the computation of real and virtual existences. This might indicate the incorporation of computing into computers, things, or space.

CREATOR ECONOMY

To create and develop tools, apps, or asset markets on earlier iterations of the internet, innovators needed to have some level of programming expertise. Nowadays, developing online applications is possible without coding thanks to web application frameworks. As a result, there are ever more designers and artists on the internet. Everyone will soon be able to create content on the internet without needing to spend hours studying programming. The economics of Web 3.0, or the creative era, is defined by this sharp increase in the number of creators. According to Jon Radoff, "In order to refocus development from a bottoms-up, code-centered approach to a top-down, artistically driven method, creators acquire tools, templates, and content markets."

EXPLORING

This is yet another crucial component of the Metaverse, which revolves around giving people the chance to find and have new experiences. The future of the Metaverse is defined by the element of discovery. Inbound and outbound systems are the two main categories for discovery systems. Users of the inbound discovery system are looking for information about their experiences. Such discovery systems include community-driven content, search engines, real-time presence, and more. Unwanted information is given to the user in the out-bound scenario, just like it is with spam, pop-up alerts, and display advertising.

EXPERIENCE

The metaverse isn't merely a 3D representation of the real world, despite what many people think. It will be the pinnacle of dematerialized distance, objects, and space. Certainly, there will be visuals, 2D and even 3D, in this area. The limitations that physicality imposes will be removed as physical space is dematerialized. As a result, the metaverse will provide us with a wide range of experiences that we cannot currently enjoy. This is one of the factors driving major businesses to prioritize enormous interactive live events right now (MILEs). By looking at these events that are hosted on websites like Decentraland and Roblox, we can get a very rough notion of how immersive events can be made available to everyone in the metaverse by looking at these events that are hosted on websites like Decentraland and Roblox.

CROSS REALITY (XR)

Cross or extended reality refers to a group of immersive technologies that bring physical objects into digital spaces. XR systems include software and hardware ecosystems to create mixed reality (MR), virtual reality (VR), and

augmented reality (AR). This section initiates with the well-perceived realm of AR-VR and discusses progressively the impending sphere of these technologies and their advanced modifications, MR.

AUGMENTED REALITY (AR)

AR has accelerated as one of the biggest trends in the field of technology currently, and it's expanding as it incorporates a different approach towards reality context and tenders to substitute experiences to users existing in the physical world. With enhanced vision, augmented reality (AR) integrates and enhances the user's perceptual interaction with the real world as opposed to a simulation. Currently, it continues to evolve and become more omnipresent among the wide diversity of its applications. Since its beginning, marketers and technology firms have had to grapple with the notion that augmented reality is little more than a marketing tool. Nevertheless, there is evidence, though, the fact that end users are initiating to get real convenience from this technology and anticipate it in the purchasing decision. A lot of research has been done to enhance how users interact with digital things in augmented reality. It is important to keep in mind that digital elements might be superimposed over the user's physical environment, possibly from a meta-version, should enable human users to combine many actions at once (analogous to VR). Thus, one of the main issues connecting human users in the real world with the metaverse is providing easy and smooth user interaction with such digital entities in AR. The result is a layer of digital artifacts that are spatially projected and are mediated by tools like glasses, contact lenses, smartphones, tablets, and other transparent surfaces [6]. In other words, AR users communicate with their digital counterparts in the metaverse while working in real-world settings. To map the exhibited virtual material with its location in the current world, extensive work in detection and tracking technologies is needed. By showing data from built-in camera sensors, it can also be used in pass-through VR headsets.

VIRTUAL REALITY (VR)

The most notable aspects of completely synthetic perspectives belong to VR. Users of VR behave like they would in the real world because they feel as though they are engaged in a new environment. The utilization of specialized multi-sensory equipment, such as omnidirectional treadmills, virtual reality headsets, and diving helmets, the modalities of sight, sound, touch, movement, and direct physical contact with virtual objects, enhances this experience [7]. By being cautious and keeping a learning mindset, people may experience the most terrifying and trying events through virtual reality. Additionally, it is utilized for academic research, military training, and obtaining expertise in hypothetical scenarios. In order to provide realistic sights, sounds, and other sensations that replicate a user's physical presence in a virtual world, current mainstream virtual reality systems either use virtual reality headsets or multi-projected environments. A user can view the virtual space, move around in it, and interact with numerous features or objects when using virtual reality technology. The impression may also be produced by specially built rooms with several huge displays, although the most common source of it is VR headsets that are put on the head and feature a little display in front of the eyes. Haptic technology may provide various types of sensory and tactile feedback in virtual reality, in addition to the usual auditory and visual input. The concept of virtual reality (VR) has existed since the late 1960s in a variety of formats. The other terms, like "artificial reality," "Synthetic environment," "cyberspace," "simulation technology," etc. were used for VR before it was widely used and accepted. Desktop VR is the newest form of virtual reality. The challenge of virtual reality is that when it comes to building virtual worlds, the longer it takes to develop a believable setting, the more realistic the environment must be. A team of programmers could need more than a year to precisely recreate a genuine area in virtual reality.

MIXED REALITY (MR)

The definition of MR has evolved through time to take into account both changes in technology and in language meanings and stories, as it is a more nuanced concept. In MR, which is commonly referred to as an advanced type of AR, the projected digital data interacts with the actual environment in real time. A non-player character in an MR game might, for instance, be created to be conscious of their surroundings and be able to hide behind a desk or a couch. Like MR and VR, they require extensive eyewear. For the sake of this research, however, we embrace the notion of MR as any fusion of AR and VR, as well as intermediary forms like augmented virtuality. The choice was made in light of the long-term technology advancement and AR's growth as an interactive medium [10]. As a result, MR

continues to be a blend of two main technologies, i.e., AR and VR. To comprehend and illustrate how these anodyne technologies interrelate with the exterior world, Milgram and Kishino developed their one-dimensional reality-virtuality continuum [8]. An illustration of this continuum looks similar to a straight line with two endpoints. The user perceives a completely virtual, as opposed to a real, world, which is indicated by the right end. As a result, VR is located at the right extremum of the spectrum, whereas AR is close to the left end. A superset of both is MR.

DEVELOPMENT IN METAVERSE

Metaverse consists of large systems and has been researching and developing in arenas like cloud computing, Artificial Intelligence, VR and AR. Until now, the metaverse has reached the ideational phase. But in today's age of digital technology, the gap between virtual ideas and reality is getting closer because of the constant development of Internet giants. Metaverse started from games and will continuously be thriving in popularity, now metaverse joined social, remote offices, and other realms. A number of venture capitalists are now calling it the upcoming Internet. Metaverse ensures a long-term development and maintenance of the molecular universe. Metaverse is set to revolutionize the world of virtual reality and foster game content, e-commerce, community, education, merchandise trade, AI, blockchain and other expertise to advance in the online environment**.** Each connection shines and brings new growth. Nowadays, companies like Samsung, Tencent, Meta, and other national and international technical expertise now begun planning to invest in space alliances of technology and equipment. The metaverse is accelerating and can become a vital part of the future, easing the attentive amalgamation of the economies in virtual and real worlds. Possibly in the near future, everyone will be able to travel freely in the virtual world.

LITERATURE REVIEW

Some studies looked at the Metaverse's impact in various application fields. Shen et al. conducted a thorough evaluation of the literature to compile information on customer behavior and the development of apps for virtual commerce. In their thorough examination of computational arts, Lee et al.[1] highlighted seven key areas that are pertinent to the Metaverse and describe cutting-edge works of art in hybrid virtual-physical environments. From a macro perspective, Duan et al.'s [2] proposal for a three-layer Metaverse architecture for social benefit included infrastructure, interaction, and ecology. In order to create more intelligent systems, Njoku et al. [9] describe how Metaverse technologies can be applied to data-driven intelligent transportation systems. The review identified three key challenges: testing new technologies; identifying and fixing car faults; and anti-theft systems. Wu and Ho looked at articles in the medical industry that discussed the usage of the Metaverse in emergency care and also pulled out other domains like education, prehospital and disaster medicine, diagnosis and treatment applications, and administrative issues. The review and identification of the Metaverse technology's potential applications in the field of health by Garavand and Aslani were presented [10]. Usmani [11] et al. propose a survey of potential applications for the Metaverse in the treatment of mental health conditions. A thorough analysis of the literature on the application of the Metaverse in learning by Tlili et al. reveals the research gaps in lifelogging, audience profiling, the lack of research focused on mobile learning, online shopping, and hybrid learning, and the lack of studies specifically examining the use of the Metaverse for students with disabilities. After reviewing the literature, defining the four categories of the Metaverse, and explaining the possibilities and restrictions of its educational uses, Kye et al.,[12] seen a gap in the Metaverse's framework for SEE after taking into account the above findings. Only Kye et al specifically addressed the Metaverse for education. Numerous studies also present the key technologies and concepts for the implementation of the Metaverse (e.g., AI, blockchain, Edge computing, XR, etc.), as well as provide an overview of the domains that use the Metaverse. There isn't a review that looks into the Metaverse for SEE, though. Consequently, the purpose of this work is to examine the state-of-the-art of the metaverse in this milieu. Given Facebook's announcement in 2021, the phrase "Metaverse" was becoming more well-known. Figure 2 depicts the most popular Internet searches starting in October 2021.

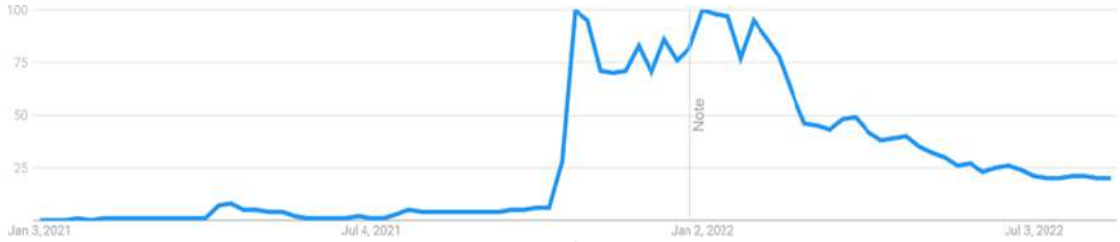


FIGURE 2. Search Records of metaverse on google trends

TABLE 1. Review of Recent Work in the Domain of Metaverse

Year	Ref	Contributions	Focus
2022	[13]	Survey to investigate variables that may affect users' acceptance of the metaverse.	Technology acceptance model
2021	[14]	Overview related to technologies, principles and affordances for the Metaverse.	Technologies and concepts
2022	[15]	A systematic literature review on consumer behaviour's and design of virtual commerce applications.	Virtual Commerce
2021a	[16]	Review of eight types of key technologies to enable Metaverse, as well as six user-centric pillars to form the Metaverse ecosystem.	Key technology
2021	[2]	Survey on Metaverse applications related to social goods	Social Goods
2021	[14]	Overview of the Metaverse development in terms of technologies, VR, social media, national policies, industrial projects, and infrastructures.	AR/VR technologies
2022	[17]	Survey to provide blockchain technical perspectives for metaverse	Blockchain
2022	[18]	Survey on the metaverse related to security and privacy aspects.	Security and privacy

ADVANTAGES

AUGMENTED REALITY BY METAVERSE FOR E-COMMERCE

The metaverse is catching the attention of the common populace as well as business enterprises with the practices of "good engagement" and "better understanding of the customers." These practices basically fall under the "customer experience," which has taken the spotlight as being the most important aspect of merchandising in modern times. In light of the recent pandemic that befell us, each business has realized the need for a virtual platform for its constant sales. But customers prefer direct interaction with the product before buying it, just as found in the survey conducted by Shopkick, which stated that 70% of shoppers believe being able to touch and see products to be an important aspect of their offline shopping experience. But the Metaverse changes things. The AR and VR facilities of the metaverse provide exactly that, that is letting the consumer interact with the merchandise before buying, all from the comfort of their homes. This revolution not only grows their customer but also helps them receive valuable feedback on the new products before actually going into the mass production phase. The Metaverse bridges the gap between the physical and the virtual, the offline and the online, giving a whole new dimension to commerce. This technology throws away the physical and geographical problems out the window by providing the experience of shopping at any time and any place. Customers can enjoy the experience of a showroom in the comfort of their homes. The ease of buying further boosts sales. The users can take a look at the product on themselves or the space they want it for and choose the best fit. As of now, the convenience of choosing their own sizes is only provided by the Ios devices, but steps are being taken so that everyone can enjoy this comfort. Just as in 1995, when 2D turned the world upside down, the Metaverse is going to change the way we shop, learn, make money, and communicate. There are a few brands that have already started to incorporate AR as a part of their online shopping experience. The AR room tool called "Room Decorator," which allows users to see how furniture and other decorations look in their homes, and the feature of Lenskart that allows users to try on glasses from a catalog before purchasing, are a few examples of how Metaverse has already started changing the world of shopping. Following them, apparel brands such as Adidas and Gucci are also considering establishing metaverse stores.

REVOLUTION IN E-COMMERCE WITH METAVERSE

This latest technology is guaranteed to accelerate and expand in the years to come, changing the dimensions of online shopping from the traditional “browse, select, click to buy” process to a "browse, experience, buy" process. Online and offline commerce are converging in such a way that the customers experiencing the Metaverse can walk around the store, view product displays, test the products on themselves, and make purchases later, all from the comfort of their homes. The Metaverse has the ability to improve and innovate on the current e-commerce practices and provide a unique experience to its users. The first benefit of e-commerce powered by the metaverse is “personalized experiences," which are currently often limited to product recommendations and discounts. The second advantage is the "lower response rate". Metaverse-powered e-commerce helps customers try products before ordering/purchasing, with improved product visualizations so users can make informed decisions. The third benefit is “increased conversion rates and increased upsells” of traffic/visitors reaching the e-commerce platform due to the personalized experience provided by Metaverse. Recent studies show that people are willing to pay about 40% more for products that can be tested in 3D. All of these cumulative benefits ultimately lead to “improved profitability” for brands, thereby revolutionizing the way brands work. Metaverse can completely transform the operating model, customer experience, revenue, and profitability of e-commerce businesses.

CHALLENGES

LIMITATIONS OF WEB - 2.0 SHOPPING ENVIRONMENTS

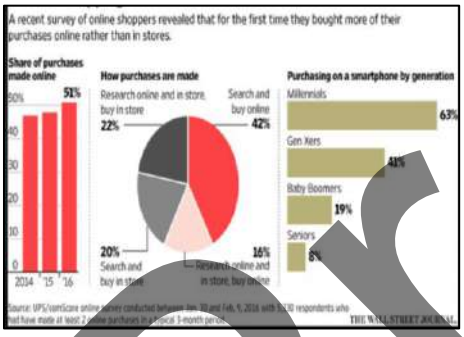


FIGURE 3. Market size of the E-commerce

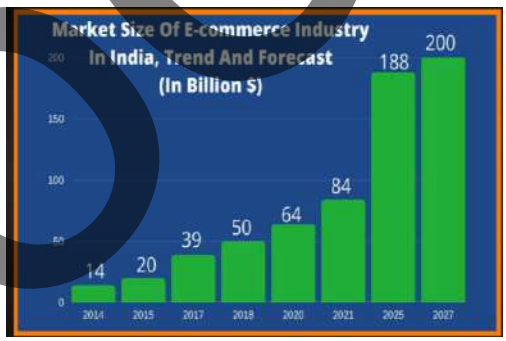


FIGURE 4. Shift in the shopping Industry in India

Growth of E-commerce over the years is illustrated in figures 3 and 4. Online shopping is becoming popular, especially among people. The surge in shopping sites has been seen after the COVID-19 pandemic, which disrupted store shopping. Remote shopping is now preferred worldwide because of health-related physical distancing measures. However, Apps running in a 2-Dimensional web-based environment also have disadvantages and incapabilities. Long hours of day-to-day use of online applications lead to many diseases, and it majorly affects eyesight. Additionally, the 2D platform has the following limitations that adversely affect online shopping:

- **Lack of shopping experience**: In 2-D applications, shoppers are unable to physically check or try on items they want to shop for. Also, online patrons often have no one to talk to if problems arise.
- **No presence**: Shoppers lack the touch and feel of the merchandise in online shopping. In addition, they cannot try on the product or touch its fabric.
- **Inactivity**: 2D platforms offer interaction options.

All of these limitations can be addressed in an immersive 3D spatial environment.

META-CHALLENGES

The Metaverse is an emerging concept but also brings new challenges intertwined with AR/VR technologies. Implementing and customizing AR is costly due to its tendency to become a stumbling block in wide adoption. In addition, AR faces several risks which include (1) addiction and mental health (2) Culpability: Privacy, and data security (3) lack of safe space. The addiction of users to augmented reality can affect their mental as well as physical health. The problem of information overload must be averted. Metaverse requires user data that can be used for malpractice. VR also causes some problems, like headaches and neck pain due to heavy weights. Moreover, users can face identity issues as fake avatars can be made, which can be used for harassing, cyber-bullying which can cause trauma or depression to users. Challenges come with an emerging technology, the same as in the metaverse, but with development and time, it will get resolved, and soon the metaverse will become the virtual world's reality.

DISCUSSION

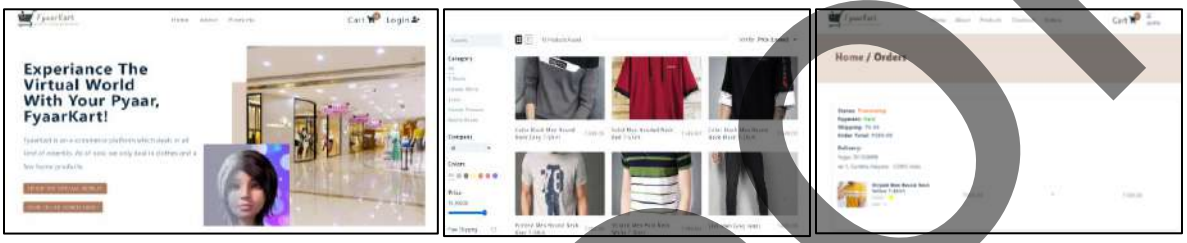
MODEL OVERVIEW

There are manifold architectural types which are incidental to Internet technologies. The Internet is available everywhere around the world, thereby connecting everyone. The primary concern in internet architecture to make it accessible is to comply with static and simple content that needs a free HTTP server accompanied by a PC. The application architecture's only drawback is that it cannot create usable directory structures or standardize HTML templates. Open-source applications are used to build this environment. This includes HTML, CSS, JavaScript, React JS, and Firebase for frontend development work and NODE.JS, MongoDB, EXPRESS.JS, STRIPE, JWT, and Cloudinary for backend development work. The Common Gateway Interface has been used in Internet design for flamboyant data like weather, prices, product availability, and sports scores. The HTTP server is used by CGI, which detects applications and refers them to the program standard, and also includes an output in addition to an input. With the help of the program, the user can choose to receive the response as HTML. The Common Gateway Interface (CGI) is available in all contemporary languages; its sole drawback is that it is an extremely expensive option. The Active Server Page technology facilitates the blending of scripts and HTML to provide scripting solutions. After returning the page's HTML components, the ASP understands the script portion. This makes it feasible for the people who are conducting operations to separate requests, distribute requests and add all the servers that are new to handle requests if they are in excess. Because the load-balancing router makes sure that the work is transferred to the backup computer, even in the event of a breakdown of the primary machine, the redundant machines used for scalability are trustworthy, ensuring availability. Being straightforward and intuitive is another guiding factor for creating web pages that are accessible and usable. Websites that are well-designed should be able to give users feedback. The website design should not be overly sophisticated in order to be simple for everyone. Users can access the website with ease thanks to its non-complex design. Because it is likely they won't use it, the design shouldn't deviate from what the user would expect. In order to foster uniqueness, the requirements and expectations of consumers are taken into account when designing websites.

FRONTEND: The main goal of the new **HTML** (Hyper Text Markup Language), or HTML5, and other tools discussed in this paper is the formal specification and construction of uniform solutions of technologies and functions through a multitude of web developers' hacks and plug-ins that have already been in use. Application programming interfaces that have recently been defined allow the programs to access these functions. These latter features include multi-media assistance, dynamic graphic rendering, geolocation, multi-threading, local data storage, etc. Semantic markup, which is a new feature of HTML5, can be used to mark up both the structure of a page and its individual elements and data. The content of a page must be kept strictly separate from its design under the new version of HTML. Only the **CSS** (Cascading Style Sheets) language is capable of styling. The latest CSS version, CSS3, has a modular design where many modules define various stylistic features. The respective modules' development cycles, support, and implementation across different browsers are all autonomous. Facebook created the well-known open source front-end JavaScript library known as **React**. Because of its simplicity, easy and efficient development process, React is quite well-liked in the developer community. Interactive user interfaces are simpler to develop with React. It effectively updates by accurately drawing each state's view's constituent parts, and it updates the application's data. Every component in ReactJS maintains its own state and is assembled into user interfaces. The concept of components

in JavaScript, which takes the place of templates, makes it simple to supply the application with a large amount of data while keeping the state out of the Document Object Model (DOM). There is also an option for rendering to be done on the server side of Node React. In addition to online applications, mobile applications can also be made with React Native.

BACKEND: In contrast to traditional relational databases, which use tables and rows, MongoDB is a document-oriented NoSQL database that is effectively used for storing enormous amounts of data. Documents, which are made up of two key-value pairs, are the basic data type in MongoDB. The collections contain groups of documents and carry out certain tasks, making them the relational database equivalent of tables. A platform called Google Firebase makes it easy for developers to build, manage, and grow their apps. It enables faster and more secure app creation for developers. The functionalities can be used more efficiently because there is no need for programming on the firebase side. It provides services for iOS, Android, Unity, and the web. It also provides online storage. The database used for data storage is a NoSQL one. This e-commerce website provides numerous great features to its users, like ease of login with email or by registration, a variety of payment options, and other functions that assist in the users' shopping experience. Some of these functions include filters by category, company, color, etc, and sorting by price and name, the ability to remove/increase/decrease the product quantities, view orders after payment, leave product reviews, and find favorite products.



(a) (b) (c)

FIGURE 5. [a-c]Glimpses of the website

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Figure 5 depicts a few glimpses of the website which has been deployed on the local server using the below-mentioned commands.

- yarn install
- yarn add firebase
- yarn start

Figure 5a shows the basic home page of the website, which has two clickable buttons. You can step into the 3D world and view the products (shown in Figure 6a), or click another option that takes you directly to a page where you can use your real-world virtual trial (Figure 8a). Figure 5b shows items available, the add to cart option, and sorting, searching, and filtering options. If you want to review a product, you need to click on any product and fill in the review form. Figure 5c illustrates the order status after the user has placed an order.

(a) (b)

FIGURE 6. [a-b] Glimpses of the website

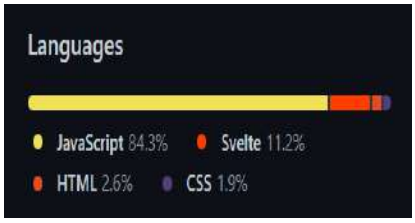

FIGURE 7. languages used

Figure 6a shows a mannequin with T-shirt, pants and spectacles, Figure 2b shows shoes in a 3D world which has been made using SVELTE. You can view and add your product to the cart.[19] Figure 7 shows the languages used in the making of this 3D world.

(a)

(b)

FIGURE 8. [a-b] Virtual Try On

It often happens that one wants to first check what a particular item looks like in its place without actually spending any money. This is a solution to the same problem. To use this feature, you have to click on the desired product that interests you the most. You may customize it according to your choice (Figure 8a). Once you have finalized your product, you need to click on a cube-shaped icon, which will directly lead you to the page that contains the QR code (Figure 8b). You need to scan the code and enjoy your product in 3D, and that too, at your own workspace.[20]

EXTENSION OF THE MODEL IN WEB - 3.0

AVATAR

Avatars in online shopping help shoppers determine a decent fit. Also, with the avatar, shoppers can interact, which results in them staying longer on the site and encourages repeated purchasing. Additionally, it could alleviate the problem of rising retail yield that is damaging the planet and businesses.

FIGURE 9.

According to Figure 9 buyers are returning products mainly because of the wrong size/fit or because the product is looking different on them which results in a headache for retailers as well as for customers. Furthermore, avatars

can also assist clients in adjusting through an interactive experience in which they are shown a lifelike avatar version of themselves. Likewise, they will be able to discern their optimum fit by gauging their size.

RECOMMENDATION SYSTEM

A recommendation system is used to recommend products to customers on the basis of their past history or on the basis of trends that improve the customer experience, and, like a virtual seller, they influence customers to buy more items. Thus, it increases the chances of a successful order. Moreover, recommendations engage users on sites, from which they end up spending more time on websites. Hence, the site is ranked better in search engines. Many websites use recommendation systems to enhance the user experience, such as Netflix, Spotify, Facebook, etc.

CHATBOT

The chatBot is a well-written program that is capable of simulating human conversations. ChatBots are used to resolve queries of humans, facing on the sites, and personalize their interactions. They are available 24*7, which ensures that no customer is losing interest due to a delay in response.

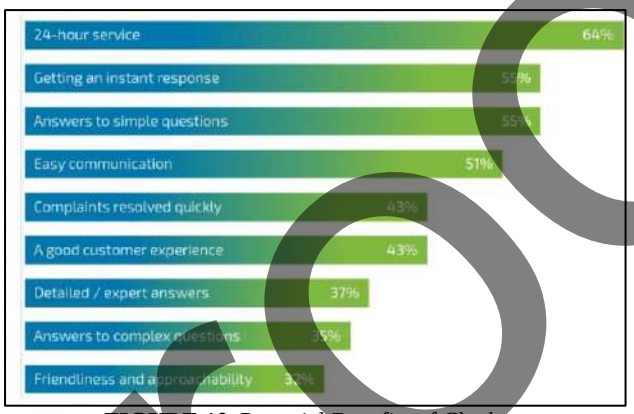

FIGURE 10. Potential Benefits of Chatbots

According to statistical data by the World Retail Congress, the world's leading merchants in the UK saw a 23% rise in revenue in 2018, in large part due to the widespread adoption of chatbots on digital e-commerce platforms. According to an additional ecommerce chatbot statistic, 40% of visitors would converse with a chatbot whenever an online store had one. By steering potential customers toward the information they require to convert, e-commerce chatbots are an immaculate tool for online shops. According to a World Retail Congress report, the largest online retailer in the UK saw a 23% boost in sales in 2018 as a result of the employment of chatbots in digital e-commerce platforms. Hence, for e-commerce platforms, chatbots are the finest tool for directing prospective customers to the data and information they ought to know.

CONCLUSION

The Metaverse enables multimodal interaction with 3-D objects, augmented reality, and people by delivering a captivating, multi-user experience to all who are using it from anywhere in the world. The rapid development of digital technology may also accelerate the entry of all sectors of society into augmented reality, fading the lines between physical and virtual existence, and thus augmenting the Metaverse. The Metaverse is gradually becoming more enmeshed in our regular lifestyle. This paper lays out an elaborate overview of the metaverse in e-commerce, defining and exploring different factors of its concepts, structure, and future scope. Online shopping using Metaverse could generate trillions of dollars and benefits brands as well as customers. In the future scope of this work, the fidelity of avatar body language and facial expressions enables equally effective virtual participation. More importantly, it will democratize online shopping, allowing global participants to participate equally regardless of

geographic restrictions. Thus, online shopping will become more individualized and extraordinary in ways that did not exist before the metaverse.

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Stock Prediction based on Sentiment Analysis using Long Short Term Memory

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Abstract. Predicting the stock market with accuracy is considered to be as one of the greatest interest to investors that could generate them money in the economic field. However, such markets are highly influenced by volatility and news; making it a significant hurdle to predict the stock index based on timing of the market. Hence, this paper proposes the implementation of deep learning algorithms that could predict the stock prices of subsequent days based on investor's emotional tendency. The experiment is conducted on TCS stocks which are amalgamated with investors sentiments collected through Twitter repository. For this, we propose to minimize the complexity of the time sequence model by adapting to regression techniques using a hybridized concept of sentiment analysis and deep learning algorithms that could incline towards improved accuracy. The experimental results so obtained conclude the highest prediction accuracy of LSTM and witnesses an overall increase in the performance of the system.

INTRODUCTION

The term financial market often refers to the exchange of monetary assets among individuals. A vital component of the financial market is a stock market, where trading of commodities and stocks occur. This provides multiple opportunities for large companies to invest and gain considerable amount of money. Apart from corporate individuals, stock traders also invest their money in stock market by selling or holding the stock. In order to gain profits and earn money out of it, traders need to track down stock prices which are expected to increase, and sell those stocks which are expected to decrease [1]. Hence, the decision of buying and selling of stocks for traders, majorly depend on stock trends and needs to be predicted accurately. On one hand where this decision is highly dependent on social media analysis, on the other hand investors cannot completely rely only on financial news websites, as these websites generate large amount of information. Hence, this becomes a challenging task for traders to predict the stock market accurately as all financial markets are versatile in nature and heavily depends on external factors such as social networking platforms and corporate news. Therefore, a self-operating system is necessary that could take the decision on behalf of investors by evaluating historical stock trends. Many research scholars have developed an automated system using the fundamentals of machine learning. Machine Learning provides certain algorithms that gain insights through financial news and utilizes large amount of historical data to predict stock prices in the future. Sentiments attached to social media posts and related financial information of stocks are two primary factors that affect the trader's decision [2]. Hence, both the factors are needed to be considered when building a predictive system for stock markets. Figure 1 depicts the impact of social media platforms on stock market.

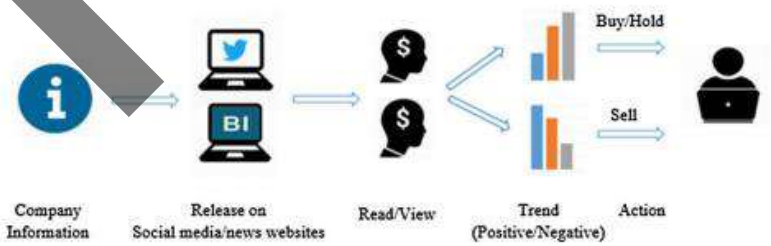

FİGURE 1. Impact of sentiments on stock market

In recent years, machine learning has gained immense popularity in the field of stock prediction by utilizing ensemble classifiers and hybridized approach to enhance the overall accuracy of the system [3]. Apart from machine

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learning, deep learning has also become a popular approach to increase the efficiency of the system. Based on fundamentals of the same concept, this paper proposes the implementation of deep learning algorithms to predict stock market by analyzing the sentiments attached to social media posts on Twitter and stock prices of a stock listed on the stock market using Yahoo finance (Ex: TCS).

Significant contributions of the research work are as follows:

- Collecting Twitter dataset for Sentiment Analysis
- Gathering TCS dataset for stock prediction
- Combining both the concepts and developing a model
- Using regression technique for stock prediction
- Proposing RNN based LSTM deep learning model to predict the same

Remaining sections of the paper are organized as follows. A detailed summary on literature survey is mentioned in section 2 followed by prediction models in section 3. Section 4 briefs on implementation of the system whereas experimental details and results are summed in section 5 preceded by conclusion and references.

RELATED WORK

The primary aim of the paper is to predict stock prices of TCS by analyzing user sentiments on Twitter. In existing stock prediction systems multiple authors have used social posts and news websites to predict the stock market. This has led them to develop models that could generate maximum accuracy as outputs and yield better performance in price prediction. This section of the paper highlights such machine learning and sentiment analysis based systems that have been previously evolved by research scholars.

"Yuan. (2016)" in [4] worked on the concept of sentiment analysis and categorized user tweets on the basis of lexicon rules. This rule was used on machine learning based algorithms to fulfil the purpose of word count and feature scoring. Annotations such as Bag of Words and Part of Speech were combined with classifiers so that the model could achieve optimum accuracy.

His same work was extended by "Lakshmi. (2017)" in [5] where he classified the tweets as positive or negative based on a heterogeneous structure. This categorization was accompanied using NB as the classification algorithm.

In another work by "Joshi and Dani. (2016)" in [6] the authors proposed a model that could classify movie reviews as good or bad based on sentiments collected from Twitter. They implemented the model using three ML based algorithms and further compared them on the basis of accuracy. Apart from financial news, breaking news is also posted online.

Authors such as "Davulcu. (2015)" in [7] made use of public sentiments from Twitter to analyze companies that employed individuals with an experience of 10 years. Hence, it is observed that sentiment analysis is a widely accepted concept that can infer to emotions and gain insights from textual data. This has resulted, the concept to gain keen interest in today's text analytics. Traders in stock market have started using multiple ML based models that could predict future stock prices using historical insights.

One such model was proposed by "Hegazy. (2014)" in [8] wherein the system could predict stock prices of S&P 500. The author implemented this using PSO algorithm combined with SVM. Optimization of the system was achieved through PSO algorithm whereas price prediction was accomplished using SVM. His model achieved a total accuracy of 86%.

In a similar work by "Chen. (2018)" in [9] he gathered the stock prices of Chinese stock market and performed deep learning algorithms on the obtained dataset. On implementation he concluded that deep learning based algorithms worked better than neural networks. For this purpose, he made use of LSTM as the base model and combined it with the concepts of CNN.

"Yetis. (2014)" in [10] proposed a deep learning model based on neural networks that gathered NASDAQ index prices to predict stock values. He used the concept of feed forward neural networks and applied feature selection techniques to predict the same. This technique enahnced the overall system of the model and further assisted investors into predicting desired stocks. İn the later stages, his work was expanded to predict stock prices of multiple companies.

PREDICTION MODELS

AN OVERVIEW OF RNN

In a traditional working of a neural network, it is rarely observed that the output from one phase is served as an input for another phase. Whereas, in real world application majority of the outputs are dependent not only on external inputs but also on previous outputs. This concept of "persistence" is however not prevailed in neural networks [11]. Hence, this inability of context based reasoning becomes a limitation of neural networks, and are therefore conceptualized using Recurrent Neural Networks. RNN's are a form of neural networks that alleviates the problem of NN's. Figure 2 depicts the working feedback loop of a typical RNN.

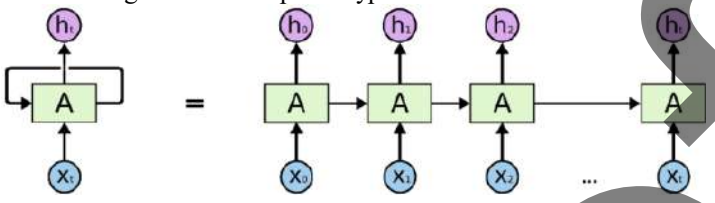


FİGURE 2: Working of an RNN

Initially, at a time step *t*, an input of X_t is given to the model to generate h_t as the output. In the next iteration, the time step of *t* becomes *t+1*, with an input of $X_{t+1,}$ leading to the generation of h_{t+1} as the output. Hence, in this way a loop is created and the generated outputs are iterated to obtain final results. However, the implementation of an RNN is still not free from limitation and tends to generate accurate outputs with only recent inputs and works miserably with historical inputs. Therefore this limitation of an RNN is overpowered through LSTM's.

LSTM NETWORKS

One of the most significant variant of an RNN network is the working model of an LSTM. An LSTM is primarily developed to handle the issues of long term dependencies [12]. A conventional RNN is made of repeating modules that has a simple chain of module structure responsible to perform iterative actions. The repeating structure of an RNN is encapsulated as the *tanh* layer as depicted in figure below:

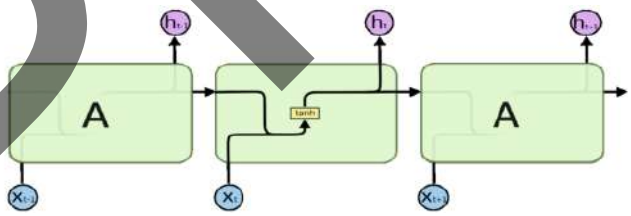


FİGURE 3. Repeating module of the RNN model

LSTM's on the other hand, consists of four layers that are responsible for the iterative action in a neural network. All the layers of the network, represents a feature vector and acts like a linkage between input and output yields. Figure below shows the iterative structure of an LSTM [13].

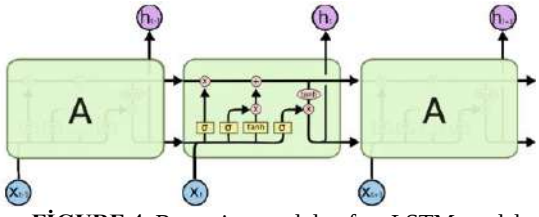


FİGURE 4. Repeating module of an LSTM model

DATA IMPLEMENTATION

To successfully implement the proposed work, we have made use of deep learning algorithms for stock prediction and concepts of sentiment analysis to extract the emotional tendency of investors that inclines their decision towards buying and selling of stocks. This section of the paper briefs about the methodologies used and the flow of steps required to implement the same.

WORKFLOW OF THE PROPOSED SYSTEM

DATASET USED FOR IMPLEMENTATION

The execution of the model occurs on two datasets obtained from Twitter database and TCS stock prices from Yahoo Finance. The database acquired from Twitter involves sentiments of investors in the form of textual format and opinions of individuals who desire to buy or sell stocks. These sentiments are in the form of text on Twitter platform and thereby get converted to numerical figures in the form of 0's and 1's; wherein 0 represents a negative opinion and 1 represents a positive opinion.

The second dataset required to implement the model is obtained from publically available repository that contains stock prices of TCS. This dataset is further used for price prediction using LSTM as the deep learning model. The snippet below depicts the dataset of TCS stocks with their respective open and close prices.

	Date	Open	High	Low	Close	Adj Close	Volume
0	01/02/2008	19.462856	19.512857	18.882856	19.107143	12.740701	262686000
1	04/02/2008	19.172857	19.414286	18.774286	18.807142	12.540651	224808800
2	05/02/2008	18.632856	19.142857	18.414286	18.460000	12.309518	285260500
3	06/02/2008	18.690001	18.845715	17.295714	17.428572	11.621424	393318100
4	07/02/2008	17.138571	17.825714	16.752857	17.320000	11.549030	520832900

SNİPPET 1. Dataset of Stock Prices

DATA COLLECTION

The process of data collection involves gathering the source of image and formatting the structure of data so obtained. The proposed implementation involves the collection of dataset from Yahoo Finance to predict the stock prices and Twitter as the social media platform to gather user sentiments. For this purpose Twitter API is used on Python. All the inputs required to analyze the sentiments are fed to Python application including the *start date* and *end date* of stocks. These stock are further selected from the dataset using the $ sign, known as cashtags. Cashtags help to narrow down the search query that is required for analysis of financial information from texts. In the next stage, the obtained tweets are downloaded from the dataset in .csv format. On the other hand, the prediction of stock prices occurs by gathering its dataset from Yahoo Finance. This dataset contains the *price data* of selected stocks in .csv format.

PRE-PROCESSING

The collected data is in the raw form and needs to be converted before applying deep learning algorithms on it. Following are the steps required in the pre-processing stage for tweet conversion:

- Tweets are converted into tokens
- Cashtags are removed as they no longer carry useful information for deep learning algorithms
- URL's are discarded
- Stop words are eliminated
- Removal of irrelevant data unnecessary columns from the dataset

The snippet below illustrates the removal of irrelavant data obtained from the database.

SNİPPET 2: Removal of unnecessary colum

	Tweets	Adj Close	Volume
0	0.100000	12.740701	252686000
1	0.100000	12.540661	224808500
2	0.100000	12.322518	285260500
3	0.050000	11.621424	393318100
4	0.100000	11.549030	520832900
...	...	...	...
2765	0.050000	155.632523	26192100
2766	0.050000	154.019440	41587200
2767	0.100000	164.544296	61109800
2768	0.047619	165.729218	40739600
2769	0.050000	165.808884	32668100

SENTIMENT ANALYSIS

The pre-processed data from the dataset containing tweets undergoes the process of sentiment analysis using VADER as the NLP toolkit. The working of sentiment analysis is majorly followed by looking onto words that could derive positive, negative and neutral sentiments from Twitter texts. Conventionally the order of words is ignored while deriving tweet sentiments and hence a large amount of valuable information is lost. To overcome this limitation, we have implemented deep learning algorithms along with the NLP approach. In the next stage, a sentiment score is calculated using VADER that represents the sentiment of a complete sentence. In the last stage, the overall user sentiments are aggregated on a specific date and a count is made. If the count is high, sentiment calculation tends to be positive, else negative. The snippet below depicts the sentiment score so obtained using VADER.

SNİPPET 3. Calculated Sentiment Scores using VADER

	Date	Tweets
0	01/02/2008	0.100000
1	04/02/2008	0.100000
2	05/02/2008	0.100000
3	06/02/2008	0.050000
4	07/02/2008	0.100000
...	...	...
2765	28/01/2021	0.050000
2766	29/01/2021	0.050000
2767	30/01/2021	0.100000
2768	31/01/2021	0.047619
2769	01/02/2021	0.050000

STOCK PREDICTION

To predict the stock prices, feature extraction process is applied on attributes that are extracted from stock files. In the next stage, values are obtained from these attributes by subtracting open values from close values. The final values so obtained are termed as Future Trends and the criteria for selecting its values are given by:

Where P_{tc} is stock today closing price and P_{nc} is stock closing price after n days.

$$Future\ Trend_n = \begin{cases} Positive & if\ P_{tc} - P_{nc} > 0 \\ Neutral & if\ P_{tc} - P_{nc} = 0 \\ Negative & if\ P_{tc} - P_{nc} < 0 \end{cases}$$

MODEL ARCHITECTURE

The working implementation of the model begins by collecting data from Twitter repository to conduct sentiment analysis and Yahoo Finance to predict stock prices of TCS. Once the dataset is collected, it undergoes data pre-processing stage wherein the sentiment texts obtained from Twitter are filtered using techniques such as tokenization, truncation, elimination of stop words and cleaning of imbalanced data. In the next stage, the obtained dataset undergoes feature extraction process wherein only the features that are relevant to price prediction are extracted. This filtered textual data is converted to numerical figures using the values obtained from sentiment score. Sentiment scores of numerical figures are used to classify textual opinions as positive or negative. This process is followed using VADER as a toolkit to give the final analysis of textual sentiments. The final dataset so obtained is now merged with the data repository of TCS stocks. Stock prices of this dataset are labelled and directions are provided to indicate stock high prices and stock low prices. Once the labelling of data is done, it further undergoes the process of data splitting into training and testing sets. It is in this stage, that deep learning based prediction models are used for testing purpose. In this study, we have implemented LSTM and RNN as classification algorithms that could predict the stock prices by combining the textual sentiments obtained from Twitter. In the final stage, results generated from the prediction models are evaluated and the final accuracy of the model is concluded.

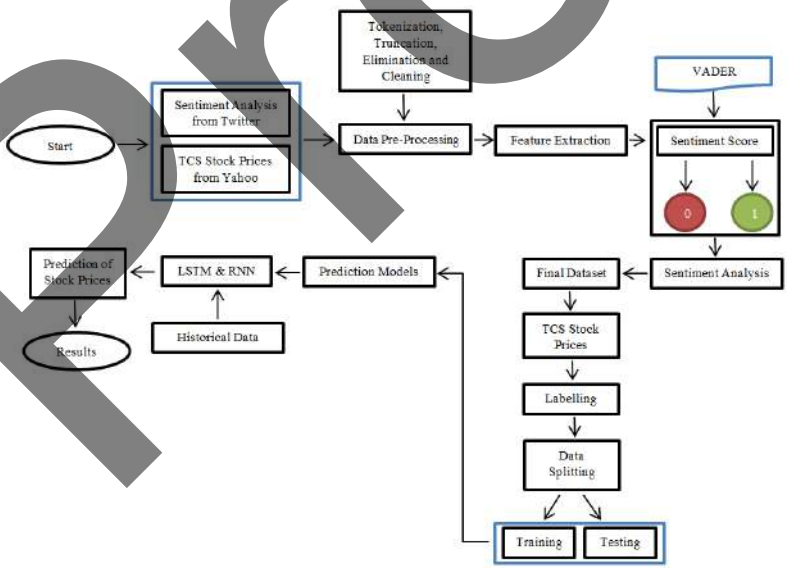


FİGURE 5. Architecture of the Proposed System

EXPERIMENTAL ANALYSIS AND RESULTS

As per the working theory of LSTM-RNN model, the network begins its construction with training of input data

into a three dimensional data vector; with 10 as the size of time-step and 8 as the number of input dimensions. To accomplish the objective of the system, data is entered onto the first dimensional layer with 32 as its vector size. Next, this vector enters the next layer of the algorithm and a three dimensional output vector (10, 32) is obtained. Further this output vector is given as an input to the LSTM layer and the algorithm is trained. The LSTM-RNN model structure is illustrated below:

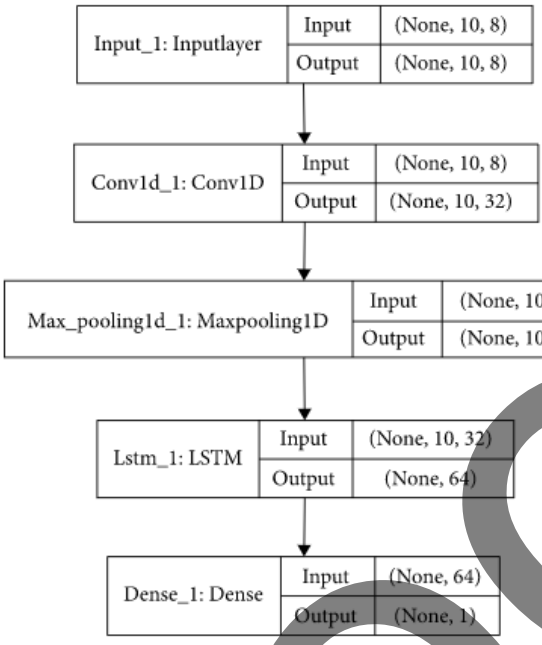
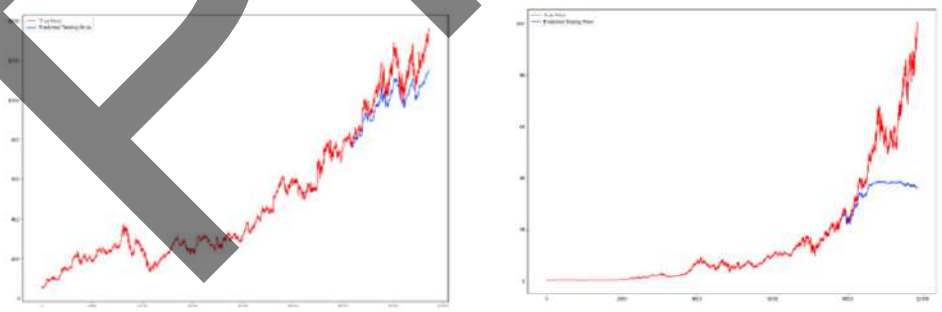
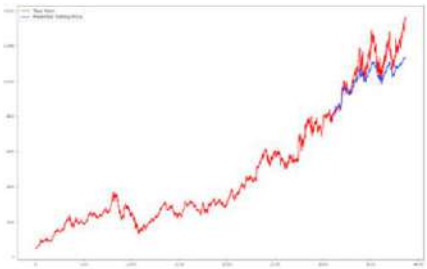


FİGURE 6. Model structure of LSTM-RNN

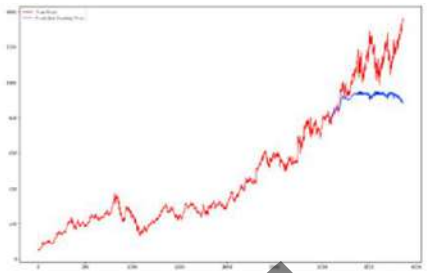
After generation of the results, it has been observed that initially the dataset was less volatile and had lower values. The results obtained from testing the LSTM-RNN model is depicted in figure 7; wherein the red lines represent real market price and the blue lines represent the predicted values by our model.



(a) At 12 epochs (b) At 25 epochs



(c) At 50 epochs



(d) At 100 epochs

FİGURE 7. Result training of TCS Stocks

The following table shows the precision of our training and testing for all epochs.

TABLE 1. Processing time for TCS Stocks

Number of Epochs	Processing Time/sec
12 epochs	264
25 epochs	550
50 epochs	1100
100 epochs	2200

The graphs below depict a considerable decrease in loss and a constant increase in accuracy that takes place in the training and validation phase.

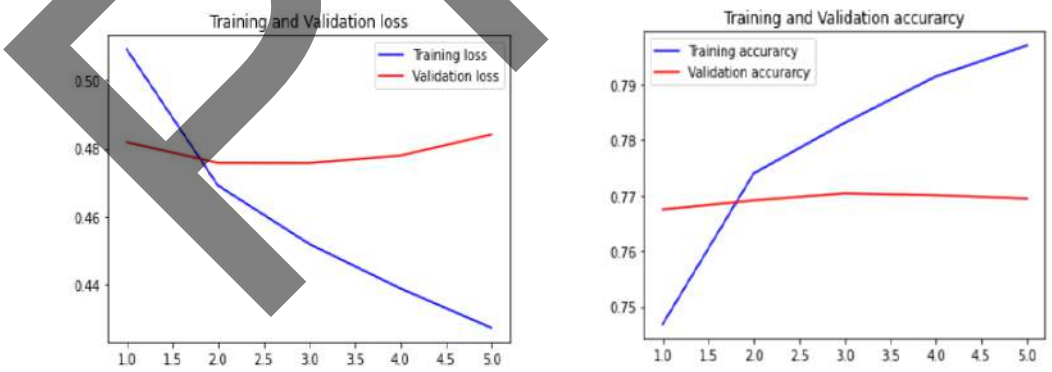


FİGURE 8. Training and Validation Loss

CONCLUSION AND FUTURE WORK

Prediction of stocks has always been a complicated task due to its volatile nature and several other factors such

as financial news on social media platforms that might affect a stock price. Hence the working implementation of the proposed study is built on the concept of RNN-LSTM based model that is used to predict the TCS Stock prices using sentiments from Twitter repository. This prediction method tends to aggregate opinion of investors on TCS stocks available on Twitter and its related stock price on Yahoo finance. For this purpose, we have used highest, lowest and closing price as inputs of stock data along with the VADER framework to conduct sentiment analysis. Along with the historical data of the stocks, LSTM architecture has been used as the machine learning based algorithm to predict the same.

Apart from the model being used, the dataset is however limited and thereby can be improved to enhance the overall accuracy of the model. In the later stages, the model could also be used for day trading purpose; wherein the investor is more likely to be interested in short term predictions. Also, the emotions used in this study, are classified as only positive and negative which can further be extended to recognizing various emotions such as fear, anxiety and disgust. Hence, this could serve as a domain for future research work

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Intrusion Detection System Based on Machine Learning Models: An Empirical Analysis

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Abstract. As of the exponential increase in the use of computer networks, there are now problems associated with maintaining the network's availability, integrity, and secrecy. Because of this, network administrators have no choice but to implement a wide variety of intrusion detection systems (IDS), which are designed to assist in monitoring network traffic to identify unauthorized and hostile actions. A security policy violation with the intention to harm is known as an intrusion. As a result, an intrusion detection system will monitor the traffic moving through computer systems on a network to check for malicious actions and known dangers.When it discovers such threats, the system will send up an alarm. There are two types of attacks that can be identified by an intrusion detection system: signature-based detection and misuse detection. In signature-based detection, an IDS uses information gathered from a database to analyze and compare the attack signatures to those that have been saved. The second type of detection is called anomaly detection, which considers the likelihood of a particular action happening outside the typical pattern of behavior. This paper aims to provide an overview of the various efforts being carried out to develop an effective IDS using machine learning and deep learning. The results of the study will be used to evaluate the performance of different classifiers. In addition, the paper also presents the results of the various studies that were carried out. These findings will be used to develop further improvements and enhance the performance of the IDS.

INTRODUCTION

Network security has emerged as an essential research topic thanks to recent interests in the field and developments achieved in the development of the Internet and telecommunication technology over the past decade. The technological advancements in the form of systems for intrusion detection provide protection for the network and all assets that are located in cyberspace. The Intrusion Detection System, also known as IDS, is an essential instrument that is used in data security to monitor and assess whether or not an intrusion attack has occurred. IDS stands for intrusion detection system, and there are three varieties: networking IDS, server IDS, and Software IDS. The network intrusion detection system (IDS) watches every packet sent over the network. While host IDS is only responsible for monitoring a particular host (server or computer). Lastly, application IDS is responsible for monitoring a number of apps that are already recognized to pose a high risk.

A variety of IDSs are available, and they are typically deployed in anomaly bases or misuse bases. These are systems that are designed to monitor and detect anomalous activities. This system is commonly used to detect new forms of breaches by analyzing live online traffic and determining if there has been a breach. This method is performed to determine if the incident occurred. When viewed from a different perspective, the values of the logged false alerts are at their highest, which suggests that some of these are attack packets. An IDS can use a combination of methods, such as the vulnerability sign registry to identify these attacks. When a new attack variant is introduced, the system will switch over to it and will not provide a false alarm.

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IDS relies on a few different strategies in order to ascertain whether or not an invasion attack has been carried out. The first method is known as the signature-based approach. In this method, known intrusion attack signatures are saved in the IDS database and then compared to the most recent data from the system. When the intrusion detection system discovers a matching, it will flag the event as an incursion. Using this method allows for a detection that is both quick and precise. However, this disadvantage is that the signature database will need to be updated regularly. In addition, there is a possibility that the system will be breached before the most recent penetration attack can be patched.

The second method is known as the anomaly-based or behavior-based approach. In this method, an IDS will determine an attack when the system operates differently than it normally would. This method can identify both known and undiscovered forms of malicious activity. Nevertheless, this strategy has the disadvantage of having a low accuracy while also having a high rate of false alarm.

The hybrid-based strategy, which is the third and final option, combines the signature-based and anomaly-based approaches. This strategy makes use of an approach that is based on signatures to detect various vulnerabilities and an approach that is based on anomalies to detect unknown assaults. Combining the two strategies might result in a more accurate detection, but it might also drive up the computation cost

Machine Learning (ML) is a learning technique that uses statistical modelling to learn data patterns from the past, and then uses new data to predict the most likely outcome. As a result, an anomaly-based strategy was utilized in the application of the ML algorithm to the IDS. As was said earlier, the obstacle that needs to be overcome here is the construction of a model that is capable of giving a high accuracy while maintaining a low percentage of false alarm.

Most of the systems that were developed for detecting intrusions were built on a signature-based approach. This means that they rely on pre-configured attacks to identify potential threats. Due to the nature of the intrusion detection systems, they need to be regularly updated to keep up with the changes in attack patterns. This is a major disadvantage since attackers can easily identify ways to attack a network on a regular basis.[8]

The development of machine learning facilitated the ability to perform detection algorithms, which detect unknown threats by comparing legitimate traffic specifications with occurrences that show discrepancy from such relatively harmless user activities. Anomaly detection was made possible as a result of the advent of machine learning. Over the years, various machine learning techniques have been developed in an attempt to improve the detection rate and reduce the number of false positives in intrusion detection systems. This study will review the performance of these techniques in various intrusion detection systems [7]

The paper's substance is broken up into four distinct sections, the first of which is an overview of the other sections' contents. In the second section, which also discusses the various ML techniques that are utilized for building IDS, a summary of the scientific articles is presented and debated. In the third section, the studies are compared based on the accuracy of the results, commonly used classification techniques, and datasets. The fourth and fifth sections, which are respectively titled "Discussion," "Conclusion," and "Considerations for Future Research Work in ML-based Intrusion Detection Systems," explore, respectively, the findings of the study as well as its implications for future research.

REVIEW OF LITERATURE

Perez et al. [1] proposed a hybrid network-based authentication strategy (IDS) that uses a variety of hybrid machine learning techniques to detect intrusions. As a testbed, they used the NSL-KDD dataset. A combination of the supervised method of machine learning known as Neural Networks and the unsupervised method of machine learning known as K-Means clustering and feature extraction was utilized in this study. The support vector machine (SVM) was combined with the K-means clustering algorithm in order to produce a second combination. The findings made it abundantly evident that the proposed combination of reinforcement methods and unsupervised learnings improves the performance of IDS by synergistically supporting one another. The most accurate results can be achieved by integrating SVM and K-means with the feature selection process. To lower the percentage of incorrect analyzes, there is a pressing need for further models that are hybrid.

In the study that Alkasassbeh and Almseidin [3] carried out, several different categorization strategies were used in an effort to find a solution to the problem of low accuracy that is commonly experienced by intrusion detection systems when they are confronted with low-frequency attacks and use artificial neural networks with fuzzy clustering. As a

result, they successfully increased the accuracy while simultaneously minimizing the difficulty of each training set by using homogeneous subsets of training data rather than a heterogeneous assortment of training data. This allowed them to improve the accuracy successfully. Methodologies such as J48 trees, Multilayer Perceptron (MLP), and Bayes networks algorithms were utilized in the study that was suggested. Of these three algorithms, J48 trees proved to be the most accurate of the three. However, their inability to do a classification algorithm to eliminate any disconnected, redundant, or undesired characteristics is one of the most significant flaws of their work.

An ensemble-based method to intrusion detection systems was created by Marzia Z. and Chung-Horng L. [4]. In this approach, the findings of a number of different computational intelligence algorithms were aggregated with the help of a voting classifier to offer a single IDS result. As a direct result of our research, the accuracy and functionality of existing intrusion detection systems have been significantly enhanced. It was decided that the Kyoto2006+ dataset would be used because it possesses a greater potential than one of the most appropriate KDDCup '99 datasets, despite being a few years older. This enables them to reach a certain level of precision in their work, but the memory of the result is rather poor in a few conditions, indicating that the percentage of false negatives is quite high in only certain situations (FPR).

A real-time hybrid intrusion detection system was proposed in [5], wherein the misuse methodology was employed to identify well-known attacks, and the anomaly methodology was used to detect novel assaults. The misuse method was used to detect well-known attacks, and the anomalous approach was used to detect novel assaults. Because the technique of anomaly detection that was used in this study was capable of detecting patterns of encroachments that were able to avoid detection by the abuse detection, it was feasible to attain a high detection rate in this study. This was made possible by the fact that the anomaly detection technique was used. The model's accuracy had to be improved day by day for it to reach a statistically significant level (92.65 percent) on the very last day of the experiment. In addition, the probability of false negatives drops dramatically as the model continues to learn and improve at using the system each day. Whenever the method is applied to extraordinarily massive volumes of data, the issue of slowness that was caused by the factor continues to occur.

Verma et al. [6] came to the conclusion that anomaly-based penetration testing has a large amount of room for development, especially in terms of the false positive rate. To achieve better results on the NSL-KDD dataset, the learning methods Extreme gradient boosting (XGBoost) and Adaptive gradient boosting (AdaBoost) were applied. Even though an accuracy of 84.253 was reached, it is required to improve the system's performance by including hybrid or ensemble machine learning classifiers. This may be done by increasing the number of classifiers that are used. There is an issue with some of the studies that have been presented in the past, and that issue is that the researchers who conducted those studies were unable to implement classification algorithm to the datasets that they used in order to remove all unnecessary, irrelevant, and redundant relevant data from the datasets.

In the research presented by Kazi Abu Taher and colleagues [7], numerous machine learning models were evaluated using a variety of machine learning methods on the NSL-KDD dataset. The wrapper methodology was utilized for the purpose of applying feature selection. Improvements in accuracy were acquired that were on par with or even better than the results produced by the prior investigations that employed the same dataset. These improvements were obtained through the use of machine learning. Because of the high number of false negatives that the model generates and the reality that the research has solely focused on signature-based attacks, a significant challenge pertaining to zero-day detection has not yet been resolved. This is due to the fact that fresh attacks have not been noticed due to the research's exclusive concentration on signature-based assaults. Some of the research being done on older intrusion detection systems is restricted in its ability to function effectively across a wide variety of datasets. This is a limitation of the research that is being done.

When Zhou et al. [8] proposed a novel web filtering system that makes use of incorporating maximum classification to selecting features, they evidenced that it was able make it more efficient while also maintaining a high level of accuracy in the detection of intrusions. This was accomplished by demonstrating that it could take advantage of incorporating ensemble classifiers with selecting features. The study was carried out with the assistance of three different datasets: the well-known NSL-KDD dataset, two freshly published datasets known as CIC-IDS2017 and AWID, and the NSL-KDD dataset. The CIC-IDS2017 and AWID datasets were also utilized in the study. The characteristics of the features that would be included in the finished product were decided using a CFS-BA-based technique. The performance of multiclass classification is improved by the use of the ensemble-based method when working with datasets that are not balanced. The model had the highest accuracy level when applied to the AWID dataset, achieving a rating of 99.90 percent accuracy.

In this study, Ahmad Iqbal and Shabib Aftab [9] make use of two different types of neural networks: a neural network - based network and an information processing bayesian network. The researchers utilized, amongst a variety of other training strategies, Bayesian regularisation, back propagation algorithm training, and other methodologies to train the IDS based on an artificial neural network. The effectiveness and performance of the planned task were examined using a variety of performance indicators, and each characteristic was evaluated on its own. It was determined that the different models surpassed one another on various performance measures, using various mitigating detection systems from the given outcome as the basis for the comparison. Furthermore, the accuracy of the feed backward artificial neural networks was higher than that of the other two networks, coming in at 98.0742%. Assessing the hypotheses on a wide range of different datasets is important in order to meet the requirement of increasing the effectiveness of the activity.

Vinoth Y. K. and Kamatchi K. [10] proposed an ensemble-based method that improves classification accuracy by combining the prediction model, Naive bayes, RNN-LSTM, and random forest. This method is referred known as "ensemble learning." This work assisted in processing data when dealing with imbalanced data besides choosing the most effective attributes which could be trained to recognize encroachment and produce notifications to network administrator implying whether the encroachment is a typical or aberrant behaviour. This was done so that the administrators would know whether encroachment is a typical or aberrant behaviour. In in spite of the fact that now the models operate to a specific degree of accuracy when applied to the NSL-KDD dataset, it is recommended that an experimental test be carried out on the most recent datasets.

An intrusion detection system that was developed by Bhavani et al. [11] and tested on the KDD-NSL dataset was created by those researchers. The method was based on individual machine learning techniques. To accomplish this goal, they turned to the methodologies of logistic regression and feature selection. The random classifier has a greater accuracy than the other two possibilities, coming in at 95.323 percent. The recommended effort did not solve either the problem of insufficient detection or the high rates of false positives.

Among the most recent projects on systems for intrusion detection was suggested by Maniriho et al [12], where an image representation recognition classification (K-Nearest Neighbor) and Interaction between the system (Random committee) have been applied to two separate datasets, NSL-KDD and UNSWN B-15. This work is considered to be one of the most recent on the topic of intrusion detection systems. In this particular investigation, it was chosen to implement a method for feature selection, which would create and make use of only the feature subsets that were the most pertinent to the dataset that was analyzed. When compared to a single machine learning technique, the researchers found that the ensemble classifier strategy performed better than the single machine-learning technique, with a misapprehension gap of 1.19% and 1.62% when using the NSL-KDD and UNSW NB-15 datasets, including both, when using the ensemble classifier strategy. This was discovered through the study. The challenges of the actual performance of IDS methods, computational complexity, and enormous data sizes should be addressed in future research. These topics are currently the subject of investigation.

The work that was proposed by Ponthapalli et al. [13] used individual machine learning approaches to detect network intrusions, and the findings were encouraging. Logical Regression, Multilayer Perceptron, Random Forest, and Support Vector Machine Were the Methods Employed in This Work Logical regression, multi-layer perceptron, random forest, and support vector machine were the algorithms utilized in this work. In this particular investigation, the KDD-NSL dataset was utilized. The research concluded that the random forest classifier is the most efficient classification algorithm for use in intrusion detection systems. They also found that the naive bayes classifier required the least amount of time to run on the data when compared to the other methods. On the other hand, the proposed method has the drawback that it can only be used to achieve efficient operation with a single dataset at a time.

MACHINE LEARNING FOR INTRUSION DETECTION

This section aims to briefly describe the various kinds of machine learning algorithms and their applications in various fields. It also explains the criteria that are used in the detection of intrusions. Due to the technological advancements that have occurred in machine learning, it is more important that these algorithms can extract information from large datasets. Machine learning algorithms are classified into two categories: supervised and unsupervised. The former focuses on learning from pre-labelled objects to predict the type of an object. On the other hand, the latter considers the standard groupings of objects as unlabeled data. Figure.1 shows the

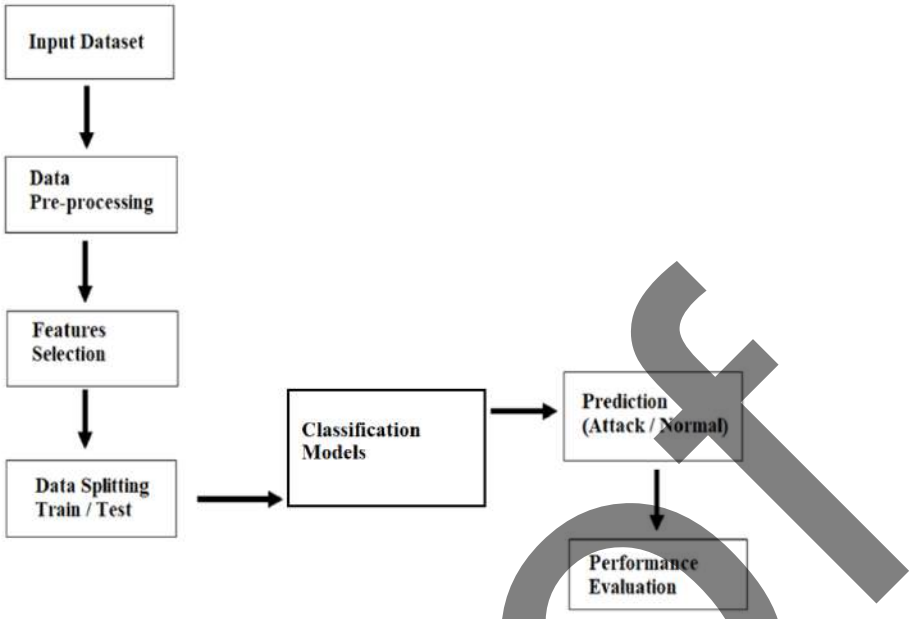

FIGURE 1. Architecture for Intrusion Detection System

This analysis mainly focuses on supervised learning algorithms that are capable of handling the KDD dataset Multi-Layer Perceptron (MLP) classifier: One of the most common functions that can be used in this area is the multi-layer perceptron (MLP) classifier. It can handle various domains, such as regression and classification, and it can be tested within a certain time.The training process for this algorithm is usually carried out over a long time. It can be performed with the help of the Multi-ML framework. This method can be used with various transfer functions such as linear, hyperbolic, and sigmoid.The various architectural issues involved in implementing the MLP method are also taken into account. Each of the network's nodes has its own random network weights. When selecting the most effective weights, the significant weight numbers are taken into account to see which parameters are most relevant to the datasets.

Random Tree classifier: The Random Tree Classification algorithm is a group that needs to be specified in order to be deployed. It is responsible for identifying the number of trees that are in the dataset. Each of these trees has its own unique properties that were chosen randomly.

The random tree grouping process can then be performed as if it were a collection of decision-making trees instead of a single entity. The prediction protocol for the whole dataset then migrates the various decision-making outputs to the new generation of predictions. The total number of votes then selects the winning class of the competition.

Random Forest Classifier: One of the most widely used algorithms for tree classification is the random forest classifier. This algorithm aims to enhance the classification of trees according to the forest principle. The results of the research carried out on this algorithm have been validated and can be used to regulate the noise levels in the data sets. The classification process does not involve a procedure for reclassification. Before implementing this algorithm, it is essential to determine the number of trees in the forest. Each physical object has its own prediction of how effective the algorithm will be. The voting method will also determine the outcome of the process [17].

J48 Classifier: It is intended that the implementation of C 4.5 method will benefit from this categorization. This classifier has the same expected outcomes as binary judgments, but it is more stable in terms of the balance between the amount of time spent computing and the correctness of the results [19]. The leaf node was responsible for making a judgement regarding the projected production in relation to the tree layout decision.

Naive Bayes Classifier: This classifier falls under the heading of probabilistic classifiers, which is the category that corresponds to it. The Bayesian classification problem theorem is utilized here. The first phase of the Naive Bayes classification approach is to figure out the total number of groups (outputs) and the likelihood of each data set class.

This is done by adding up all of the outputs. After that, the conditional likelihood of having each attribute will be calculated. You can find the Naive Bayes basic format in the investigation that was just presented [8]. In addition to this, in contrast to the MLP classifier Naive Bayes [11], it is possible to implement this type of framework in a short time with both continuous and discrete features. While this is happening, a representation of the Naive Bayes Network(BN) or Confidence networks might be made. The latter encourages the presentation of independent, framework-based conditional probabilities. In most cases, the BN algorithm takes the form of acyclic chart, which connects various attributes to a predicted output.

Decision Table Classifier: The primary goal of this classifier is to provide a search table that may be used to assist in determining the expected output class. There are a number of different searching algorithms that may be employed to improve the effectiveness of the decision table. Some common types of searching algorithms commonly used include the genetic algorithm, cross-validation, and the width of first search. The desired behavior should be applied to the conditions that have been set in the search table. In order to forecast future inputs, the decision table classifier should follow the necessary rules. It is possible to create a search table for the decision table that can be used in other sectors, such as when there is a significant gap between the rules already established in a global system and the complexity of the system in question.

From the above literature we observed that KDD Cup 99 and NSL-KDD are two datasets that are utilized extensively in the field of intrusion detection, even though both have several drawbacks. CICIDS2017, which CICIDS produced, was one of the two more recent datasets utilized in this study to circumvent some of the shortcomings that were present in the datasets that came before it. For practical and authentic results, we implemented the above discussed state of algorithm on these three datasets. In addition, we implemented the CNN algorithm along with the hybrid CNN-MLP model. For the experiment, we took a sample of 55,000 instances from each dataset. As a result, the accuracy of the models on each dataset is obtained. The quantitative data on accurate and inaccurate classification is presented in Table 1.

TABLE 1. Analysis of Correctly and Incorrectly classified instances for all the three datasets

	KDDCup99		NSLKDD		CICIDS2017	
Classification Algorithms	Instances Correctly Classified	Instances Incorrectly Classified	Instances Correctly Classified	Instances Incorrectly Classified	Instances Correctly Classified	Instances Incorrectly Classified
CNN-MLP	50974	4026	51568	3432	51221	3779
CNN	45771	9229	45491	9510	47966	7035
SVM	43560	11440	41987	13013	42416	12584
Random Forest	42537	12463	39969	15031	41190	13810
Decision Tree	42955	12045	43577	11423	40398	14602
Naïve Bayes	38566	16434	39176	15824	38319	16681
KNN	35568	19432	34771	20229	37499	17501

RESULT AND DISCUSSION

From the literature review we selected few standard algorithms for our study. The selected algorithms are CNN, SVM, Random Forest, Decision Tree, Naïve Bayes and KNN. The ground for selection was the performance of each algorithm observed from various study. To keep the approach more practical and real time, the selected algorithm were implemented on the standard datasets. The dataset used in the study are KDDCup99, NSL-KDD and CICIDS2017. For implementation we used the WEKA Library. Apart from all this algorithm, we implanted a hybrid

combination of CNN-MLP algorithm. The accuracy and analytical representation results are presented in table 2, followed by the figure's graphical representation. 2, 3, and 4, respectively for each datasets.

TABLE 2. Analysis of Accuracy of all the Algorithms on each datasets

Classification Algorithm	Accuracy for KDDCup99 Dataset	Accuracy for NSLKDD Dataset	Accuracy for CICIDS2017 Dataset
CNN-MLP	92.68%	93.76%	93.13%
CNN	83.22%	82.71%	87.21%
SVM	79.20%	76.34%	77.12%
Random Forest	77.34%	72.67%	74.89%
Decision Tree	78.10%	79.23%	73.45%
Naïve Bayes	70.12%	71.23%	69.67%
KNN	64.67%	63.22%	68.18%

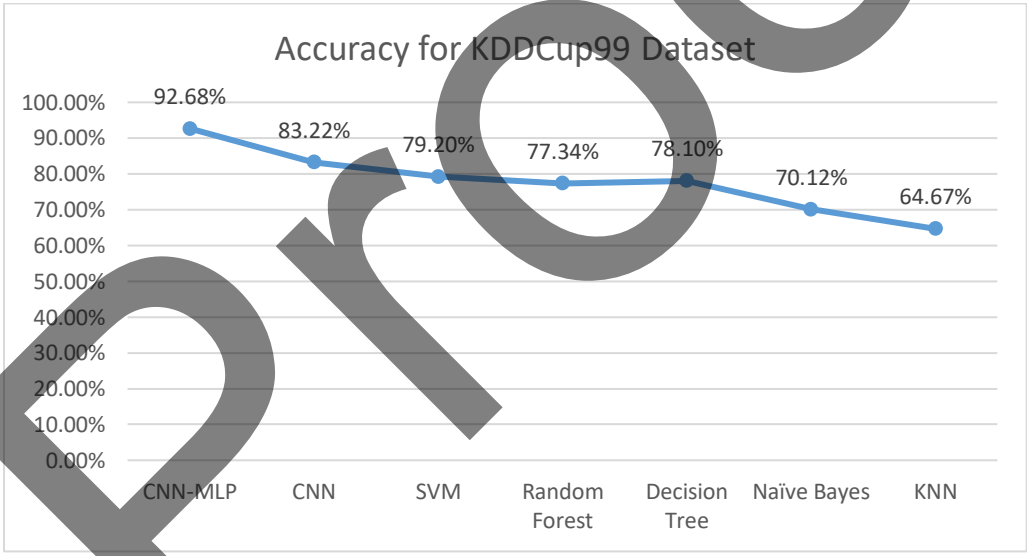

FIGURE 2. Accuracy comparison for KDDCup99 Dataset

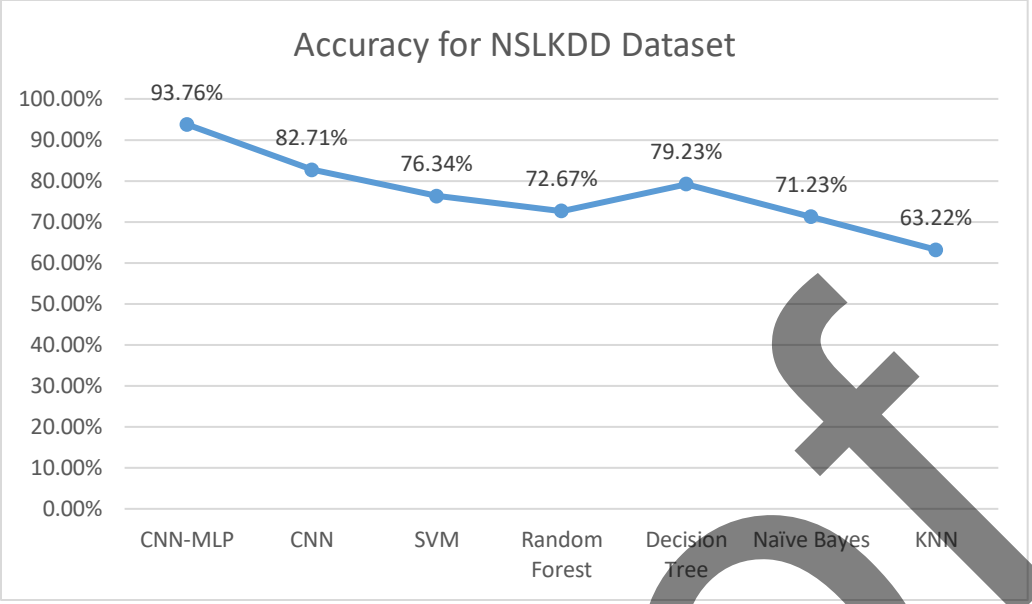

FIGURE 3. Accuracy comparison for NSL-KDD Dataset

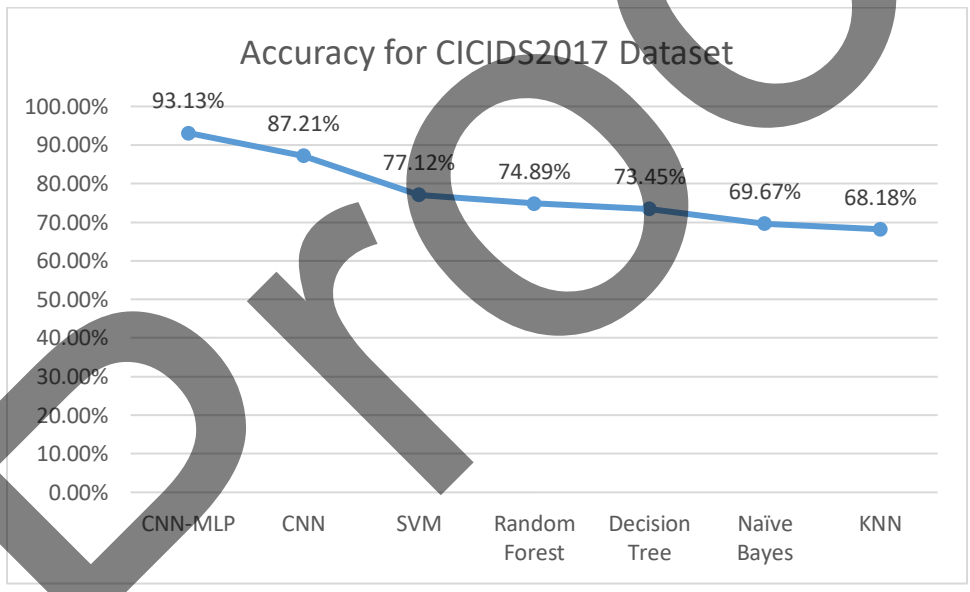

FIGURE 4. Accuracy comparison for CICIDS2017 dataset

From the above three figures it can be observed that the hybrid CNN-MLP model gives the highest accuracy for all the three models. Whereas KNN is the least performing algorithm among the selected models

CONCLUSION

Machine learning has led to the development of new approaches for detecting intrusions. Researchers and academics have used various classification schemes to develop models for these systems. This study aims to comprehensively analyse the various aspects of machine learning in intrusion prevention systems. In the published research articles, the hybrid and ensemble models were shown to outperform their single-class classifiers. They also had a higher detection rate and performance.

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An Intelligent Vehicle Number Plate Tracking System based on CNN-VGG16 Model

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Abstract. In our modern age, when innovations appear seemingly overnight, there is a great deal of interest around individuals regarding how to live and travel more safely.The total number of automobiles on the road has increased over the last ten years.. With the massive increase in the automotive industry daily, tracking each car becomes a challenging and time-consuming task. This study proposes using roadside surveillance cameras to aid in the operation of an intelligent vehicle tracking system capable of monitoring fast-moving cars. The technique of obtaining CCTV footage with a real-time background is a highly laborious one. To solve this issue, a powerful deep learning approach is being utilised for the object detection process. The job is divided into four main phases. The first stage involves creating images, while the second stage involves the placement of the car in each frame.. The subsequent stage entails identifying the license plates of the automobiles that have been located. In the final stage, the characters that are read off the number plates identified are recognized. The deep learning model that was presented makes use of CNN and VGG models to simplify the training phase. The image dataset of the license plates are utilised in the process of evaluating the effectiveness of the model. Among the models implemented for tracking and identifying the vehicle number plates, the CNN algorithm attains an accuracy of 85.8%, whereas the VGG models achieve an accuracy of 87.8%.

INTRODUCTION

In most regions of the world, breaking traffic laws is acknowledged as a primary contributor to road accidents, and the bulk of these incidents occur in developing nations. Even though there are rules and regulations in place that specifically forbid this, the number of people breaking these rules is on the rise. Because of the dramatic growth in the amount of vehicle traffic on the roads, there has been a massive uptick in need for technology to monitor and direct traffic flow. In this situation, it is nearly impossible to monitor vehicles moving quickly on the road physically. There will be a loss of both time and human resources due to this. Even if it is powered up, that will still indicate a significant amount of difficulty and a significant amount of mistake.

There are currently available systems that use machine learning techniques to track the vehicles and their license plates. Unfortunately, the algorithms used in the automatic vehicle tracking system fail when run in real-time. This is because the complexity of the data processing process involved in running the system in the background greatly affects its performance. An effective solution to this issue is the creation of an automated process that will allow the tracking of vehicles using their number plates.. This system also recognizes license plates. It is a sophisticated machine vision system that can locate vehicles based on their license plates without requiring direct involvement from a human operator.

The use of machine vision technology has seen significant advancements in recent years, particularly in the automatic number plate recognition field. It is anticipated that in the future there will be other advances made. It can support a diverse range of communities because of the effective and helpful applications that it provides, such as a parking management system, a toll charge collecting system, a vehicle penalty collection system, an on-road vehicle tracking system, and so on. Most of the world's population lives in urban areas, where residents are required to find safe parking spots to protect their vehicles from being broken into by strangers. ANPR is also helpful in collecting fees at tolls by recognising the number plate on the vehicle. Tracking vehicles' locations also assist with collecting fines from drivers who deliberately disobey traffic and road regulations. Additionally, it helps in keeping a record of the passing traffic currently on the road.

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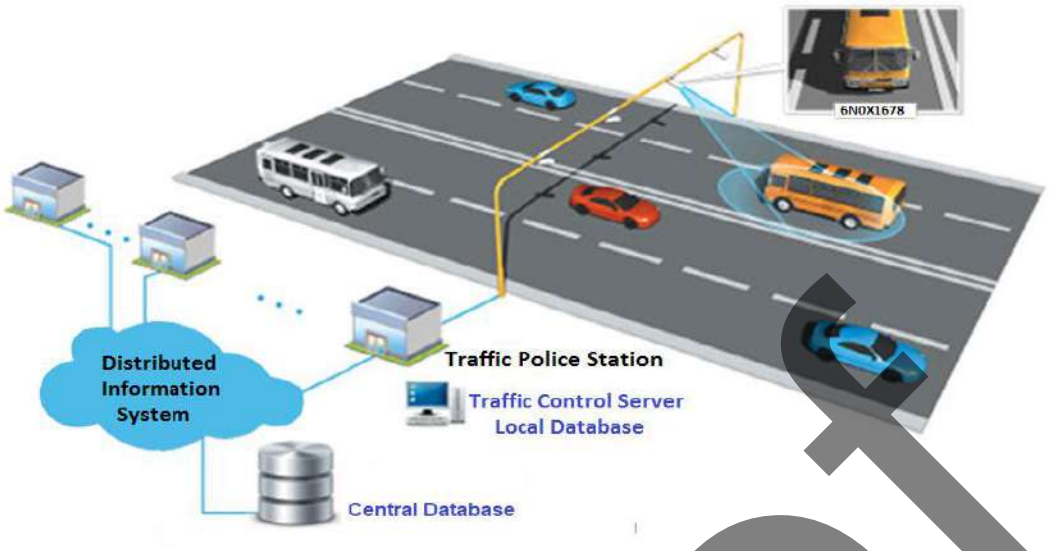

FIGURE 1. Intelligent Vehicle Tracking System

This article develops a practical foundational framework that can be used for all of these purposes. This INPR is an extremely difficult exercise to complete. When taking into account the pace at which the cars are travelling, the collected photos need to have adequate brightness, intensity, and clarity to be processed further. In addition, the viewpoint from which the photographs are taken is a significant component. The fact that each country uses its own particular standard for printing license plates presents the greatest challenge. However, there is no such thing as a standard for this in India. The font, the spaces, the letters, and the numbers may be all different. The primary goal of the research is to detect and identify Indian registration plates with greater precision.

The Convolutional Neural Network (CNN) and the Vertical Gradient Graph (VGG) are the two deep learning models that are utilised by this system to recognize autos and number plates. The system's primary objective is to create a deep learning model that, when combined with the surveillance camera, will be able to read the license plates of fast-moving vehicles on the road and then preserve the data that is gleaned from those plates in an excel sheet. In addition to this, it applies a number of different image processing methods to the frames that have been collected. An effective annotation tool known as LabelImg is utilised to annotate photos. Python is used throughout the entirety of the system as the language of implementation.

RELATED WORK

The various stages of recognition systems are responsible for identifying and enhancing the image captured from a digital image. These include segmentation, digital image enhancement, and character identification. A great variety of systems have been proposed and utilised for the purpose of vehicle license plate identification in the research that has been published.

Cheokman et al. [4] demonstrated the use of morphological operators for the image's preprocessing. Following the preprocessing step's completion, the template matching approach was implemented for character recognition. It was provided for the automobile registration plate that is formatted in the Macao style.

Cross-validation and scaling were performed to remove outliers and find the clear parameters when using the Support Vector Machine approach.. This was described in [5]. When it came to character recognition using the SVM method, the accuracy rate achieved by the Neural Network (NN) system was significantly higher.

Prabhakar et al. [6] suggested the use of a webcam for the purpose of photographing objects. This method is able to localise multiple sizes of license plates using the photos that have been taken. After the plate has been localised, the elements are segmented and identified with the assistance of multiple NNs.

In [7], a Sobel colour detector was utilised for the purpose of identifying vertical edges; this allowed the inefficient edge to be eliminated. The template matching method was the one that led to the discovery of the plate region. Both linked component analysis and mathematical morphology were used to segment the data. The radial foundation function of a neural network was also utilized., Chirag Patel [8] suggested mathematical morphology and linked component analysis as methods for identifying and segmenting characters.

The number plate detecting system in [9] relied on the characters' colour and the plate's background to pinpoint the plate's location. The columns sum vector was chosen to be used for the segmentation process. Character recognition was accomplished with the help of an artificial neural network (ANN).

The method described in [10] is a tool that can be used to recognize Chinese license plates. First, it converts the image into a binary format, and any noises that were present in it are eliminated. After that, the image's feature is extracted, and the image is normalised so that it is 8 by 16 pixels. Following the completion of the normalisation process, the recognition process is carried out by the back-propagation neural network.

Ziya et al. advocated the use of fuzzy modeling to identify the registration number, and Fuzzy C-Means was used to segment the plate [11]. The clustering and blob labeling techniques enabled the segmentation method to achieve a performance of 94.24% [12]. The number plate was placed using a keypoint label, a Gabor filter, and a threshold. in [13]. After the segmentation process was complete, a self-organizing map (SOM) neural network was utilised for character recognition [13]. Both segmentation and character identification were carried out with the assistance of a two-layer Marko network in [14]. Publications [15,16] contain further works on the detection of license plates that are similar.

Maulidia et al. [17] described a method for transforming an RGB image into a binary image, with the accuracy of Otsu and K-nearest neighbour (KNN) being obtained in the process. This allowed for the extraction of characteristics from the image. The process of transforming pixels into binary form was accomplished through the use of feature extraction in pattern recognition. The Otsu method was used to extract features from the image, and then the KNN classifier was used to categorise the image by matching the neighbourhood testing data to the training data. The test data were decided by applying the learning algorithm to a classification stage, which organises the test data into classes. This procedure groups the test data together. The Otsu method was established on the basis of a pattern recognition procedure using a binary vector. This process was done without affecting the threshold value in any way. In order to produce binary segmentation, an adjustment was made to the proportion of the pixel values throughout the image. The utilisation of KNN classification was shown to be of significant assistance in recognising the license plate of the vehicle. However, the researchers did not disclose any information regarding the system's capacity to recognise faces in adverse environmental conditions.

A supervised machine learning approach called K-means was presented by Liu et al. [18] to separate the license plate characters into subgroups, which were then categorised even more using the Support Vector Machine (SVM). Their method could distinguish slightly blurry license plate photos, which improved the classification accuracy. This system was able to discern between the various barriers in character identification thanks to the tilt of the camera, the velocity of the vehicles, and the light and shadow in the surrounding environment. The camera picked up images of characters, but they were so faint that they were unrecognisable. The massive amount of samples significantly raised the burden of the SVM classifiers, which in turn had an effect on the accuracy.

The KNN technique was utilised by Quiros et al. [19] the goal of this project was to create number plate characters that are representative of the various types of vehicles that are commonly seen on a highway. The system was proposed using a camera installed on a road that captured images of the vehicles. After identifying the contours of the number plates, the system was able to determine their sizes and reproduce them in different ways. The KNN algorithm was used to classify the various contours of the number plates. It was trained using various sets of data, each containing 36 characters: 26 alphabets and 10 numeric digits. The approach was validated using characters that had already been segmented, and the results were compared to those produced by character recognition methods such artificial neural networks. In comparison to the previous research, the performance of their proposed system was inadequate in terms of character recognition.

Thangallapally et al. [20] developed a method to recognise the characters printed on license plates and upload information about the vehicles into a server. The image of the car number plate was then extracted after this was segmented in order to do so. The procedure resulted in the characters from the license plate being separated into their respective compartments, after which KNN was used to retrieve the characters that were then uploaded to the server. Recognizing the license plates from hazy or unclear photographs was a challenge that needed to be overcome during this process.

Singh and Roy [21] presented a proposal for a vehicle number plate identification system in India, which is a country with a variety of challenges, such as an abundance of font sizes, a variety of colours, double-line number plates, and so on. The artificial neural network (ANN) and support vector machine (SVM) were utilised, respectively, in order to recognise characters and detect plate contours. Although a number of techniques have been used in published works to reduce noise and improve license plate recognition, artificial neural networks (ANN) have shown promising results in alleviating camera restrictions.

Machine learning algorithms, such as ANN, KNN,and SVM were used by Sanchez et al. [22] to construct a system for the recognition of vehicle number plates in the United Kingdom. The machine learning (ML) method and various

computer vision techniques were used to process and evaluate the image of the car once the system received it. The study's findings revealed that the system can recognise the vehicle's license plate simply by looking at a picture of it.

Panahi and Gholampour [23] developed a system that could detect illegible license plate numbers caused by inclement weather or high-speed cars in a variety of various types of traffic scenarios. The image data collected from various roads and highways was used to develop a comprehensive picture of the vehicle registration plates. The technology presented was able to adapt to the plates' varying sizes, shapes, and readability. This paper aims to provide a focused collection of solutions to the problems and challenges that are related to the identification of vehicle registration numbers.

Accurate classification of vehicle number plates was accomplished by Subhadhira et al. [24] using the deep learning technique, which was also utilised for the training processes. The first portion of this system preprocessed the image and retrieved characteristics using a histogram of oriented gradients (HOG). The second element of this system categorised each number and alphabetical letter that appeared on the license plate so that it could be studied and segregated. The ensemble learning machine (ELM) was employed as a classifier, and the HOG algorithm was used to extract essential characteristics from the plate to recognise Thai characters written on the number plate. The ELM system carried out its tasks more effectively than its competitors thanks to the rapid speed of its training and testing tenets. Character recognition has been accomplished by using various approaches in earlier works, such as pattern recognition, as well as many classifiers, SVM, and ANN. Regarding the template matching procedures, the unclear characters were not addressed at all. SVM was unable to be supported for the illumination ambiences and the alignment of each character on the damaged number plates.

In order to address the concerns about the authenticity of the vehicle's registration plate region, a template matching method is used to extract it from the image. A super resolution technique is also used to improve the quality of the captured image. After that, a character recognition algorithm is then used to segment the characters from the captured image. CNN uses a gradient-based learning algorithm to solve various problems, such as diminishing gradients. It has also updated its activation functions to include a Rectified Linear Unit(ReLU) [25].

Training is carried out using a method based on gradient descent, which also generates models to minimise mistakes and updates the weights in accordance with those changes. Therefore, improved prediction accuracy can be achieved by providing highly tuned weights when the model is being trained. CNN is able to represent images in either the two-dimensional (2D) or three-dimensional (3D) domains with relevant characteristics, which can contribute to improved recognition performance. In particular, the max-pooling layer of CNN is able to handle shape invariant image problems, in addition to scale invariant image problems. In addition, the technique employs a relatively small number of network weights compared to conventional neural networks of a size comparable to the one being studied.

PROPOSED METHODOLOGY

Acquiring dataset, transcribing the dataset using CNN and VGG, and testing done using python are the three primary modules included in this method. Every proposed method is composed of a collection of modules. For training and testing, several distinct collections of images have been used.

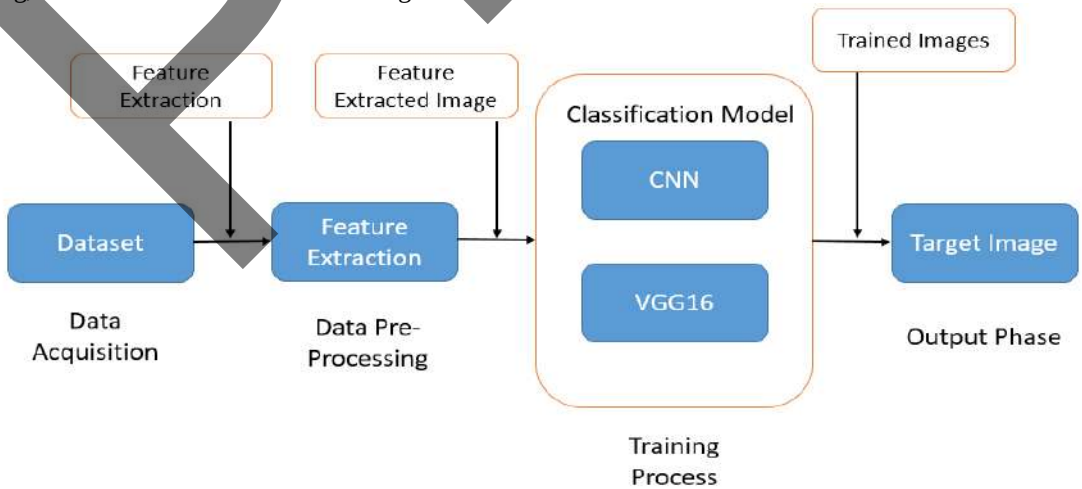

FIGURE 2. Proposed Architecture

CONVOLUTIONAL NEURAL NETWORK MODEL

Convolutional Neural Networks perform functions that are very similar to those performed by neural networks such as the Perceptron. The difference is only we don't have to flatten the input picture in this case. For example, if we have an input image with a dimension of 96 x 96, we will need to perform 9216 operations on it to get the weights. CNN uses a limited set of weights (7 x 7 = 49, where 7 is the kernel size) that are applied to a large number of tiny subsets of the picture of the same size, as opposed to traditional machine learning techniques. Rather than pixel pictures, it incorporates the 'local' characteristics discovered in the preceding concealed layer but instead of pixel images. Furthermore, the corresponding output layer will compress the original image to a vector representation of output value, rather than the whole image. As a consequence of the fact that perhaps the input consists of pictures, Convolutional Neural Networks take use of this and limit the design in a more reasonable way. For instance, the layers of a CNN differ from the layers of a conventional Neural Network in that the neurons are organised in three dimensions: width, height, and depth. In this project, we will be using photos with the following dimensions: 96x96x3 (width, height, depth respectively).

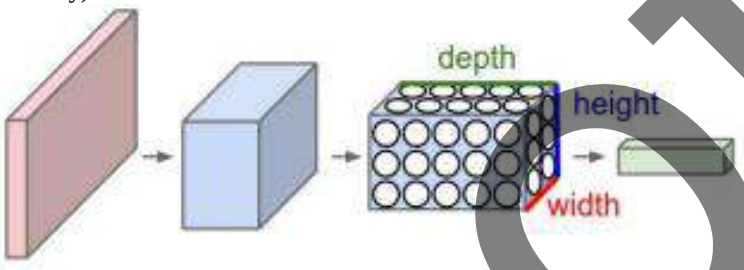

FIGURE 3. Layers of CNN

Figure 3 illustrates the left side shows a standard three-layer Neural Network. The right side shows a ConvNet that organizes its neurons in 3 dimensions. Every layer of the network translates the input volume into a sequence of neuron activations. This transformation happens at every layer. The red input layer shows the picture, while the height and width of the layer correspond to the dimensions of the image. The depth of the layer is also 3 pixels (Red, Green, Blue channels).. In recent years, the deep neural network-based technique CNN, which is based on the extraction of features, has proven outstanding strength in this area. For more full learning of price sequences, we apply a CNN to extract numerous time scale properties, inspired by earlier research and detailed below. Meanwhile, due of the internal memory architecture, the network functions well enough when dealing with sequence information that has long-term dependencies on other information.

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 28, 28, 32)        55328
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 14, 14, 32)        0
_________________________________________________________________
dropout (Dropout)            (None, 14, 14, 32)        0
_________________________________________________________________
flatten (Flatten)            (None, 6272)              0
_________________________________________________________________
dense (Dense)                (None, 128)               802944
_________________________________________________________________
dense_1 (Dense)              (None, 36)                4644
=================================================================
Total params: 862,916
Trainable params: 862,916
Non-trainable params: 0
_________________________________________________________________
```

FIGURE 4. Configuration of CNN

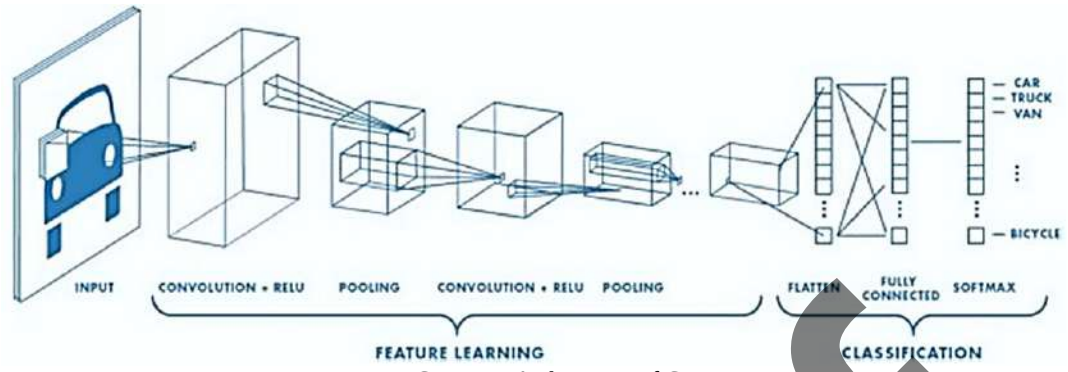

FIGURE 5. Architecture of CNN

VGG16 MODEL

It proposed using a small 3 x 3 receptive field in the network, which is equivalent to a pixel stride. In the first layer of AlexNet, the receptive field was 11 x 11, while in the second layer, it was 7 x 7. The idea of using 3 x 3 filters is to make the VGG stand out. For instance, two 3 x 3 filters can provide a receptive field of 5 x 5, while three 3 x 3 filters can produce a receptive field of 7 x 7. This allows a combination of these to stand out in a larger area. One of the main reasons why many people think that using three 3 x 3 layers is unnecessary is because it increases the complexity of the network. However, in addition to the three layers, three activation layers are non-linear. This makes the decision function more discriminative, which helps the network converge faster. In addition to reducing the number of weight parameters, it also helps in the model by decreasing the number of input and output weight parameters. For instance, if a three-layer 3 x 3-convolutional stack has C channels, the total number weight parameters will be 32 C2. If we compare this with a 7 x 7 layer, the total weight parameters will be 72 C2.

This is another reason why many people think that using 3 x 3 layers is unnecessary. It allows the network to reduce the tendency of over-fitting during training. For instance, by decomposing the 7 x 7 filters through the 3 x 3 layers, the network can avoid over-fitting. Another reason why many people think that 3 x 3 filters are unnecessary is because it provides so many benefits. However, the size of these filters is considered to be the smallest to capture the idea of left to right and top to down. Lower the filter size could affect the model's ability to understand the spatial details of the image. The use of 3 x 3 layers in the network made it very easy to work with. It also provided a consistent and elegant look.

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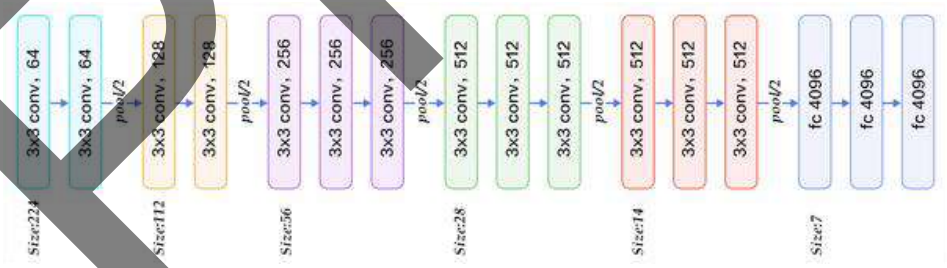

FIGURE 6. Structure of VGG16

The image is then processed through a series of conv layers, which are also known as cov1 layers. These layers are used to apply various filters and are designed to capture the concepts of left, right, and center. The smallest size that can be used to capture these concepts is 3 by 3. One of the configuration's features is a 1x1 convolution operation, which is used to transform the channels fed into it. This procedure can be regarded as a linear transformation. The conv layers' spatial padding size is always set to 1 pixel for 3x3 convolutional layer. This ensures that the output of the operation is always maintained. This is because the spatial resolution of the resulting image is maintained. Five different max-pooling layers are then used to perform spatial pooling. These layers are responsible for following some of the conv. layers and carrying out the pooling process. Max-pooling is performed over a pixel window that is 2 by 2.

A stack of various types of deep convolutional layers is then followed by three FC layers, which are each equipped with 4096 channels. The first two FC layers are designed to perform 1000-way ILSVRC categorization, while the third layer is designed to perform 1000-way ILSVRC categorization. The final layer, which is the soft-max, is the only one that is fully connected. The configuration of the layers in a network is the same regardless of the architecture. The rectifying (ReLU) non-linearity is built into each of the hidden layers in its entirety. It should also be mentioned that none of the networks, with the exception of one, use local response normalisation (LRN). This kind of normalisation does not enhance performance on the ILSVRC dataset, but it does increase the amount of memory used and the amount of time needed to compute results.

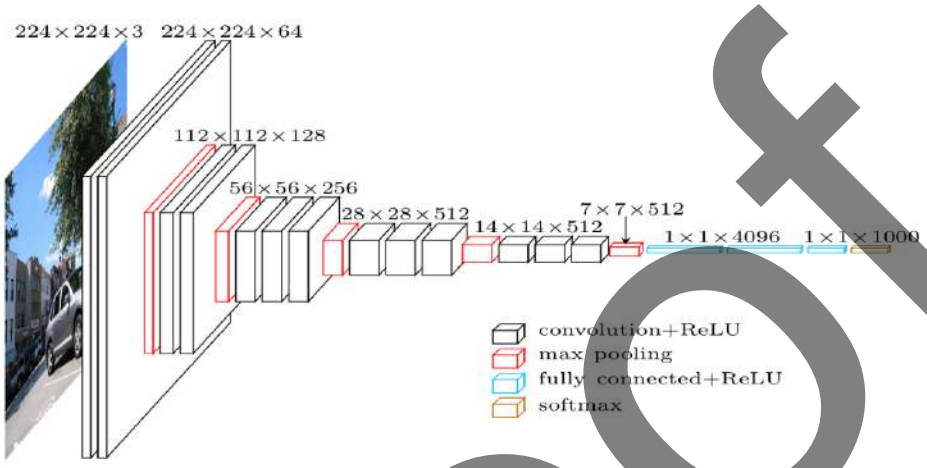

FIGURE 7. Architecture of the VGG16

Following figure 7 provides an overview of the various ConvNet settings. The names of the nets are used in this sentence (A-E). The only difference between the configurations is the number of weight layers, The architecture consists of eight conversion and three FC layers in network A, and 19 in network E. It follows a general design, and a 16-conv follows all configurations. and three FC layer. The number of channels in the first layer is relatively limited, starting at 64 and growing by a factor of two until it reaches 512. Maximum number of channels.can be used is 512

```
Model: "sequential_9"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_20 (Conv2D)           (None, 27, 27, 32)        416
_________________________________________________________________
activation_30 (Activation)   (None, 27, 27, 32)        0
_________________________________________________________________
max_pooling2d_19 (MaxPooling (None, 13, 13, 32)        0
_________________________________________________________________
conv2d_21 (Conv2D)           (None, 12, 12, 32)        4128
_________________________________________________________________
activation_31 (Activation)   (None, 12, 12, 32)        0
_________________________________________________________________
max_pooling2d_20 (MaxPooling (None, 6, 6, 32)          0
_________________________________________________________________
conv2d_22 (Conv2D)           (None, 5, 5, 64)          8256
_________________________________________________________________
activation_32 (Activation)   (None, 5, 5, 64)          0
_________________________________________________________________
max_pooling2d_21 (MaxPooling (None, 2, 2, 64)          0
_________________________________________________________________
flatten_7 (Flatten)          (None, 256)               0
_________________________________________________________________
dense_14 (Dense)             (None, 64)                16448
_________________________________________________________________
activation_33 (Activation)   (None, 64)                0
_________________________________________________________________
dropout_7 (Dropout)          (None, 64)                0
_________________________________________________________________
dense_15 (Dense)             (None, 36)                2340
_________________________________________________________________
activation_34 (Activation)   (None, 36)                0
=================================================================
Total params: 31,588
```

FIGURE 8. Configuration of the VGG16

RESULT ANALYSIS

The accuracy score and loss score for the training set are displayed in Figure 2 for epochs 1 through 25. At period 25, CNN achieves an accuracy score of 85.8% for the training set, whereas the loss at epoch 25 is 0.45%.

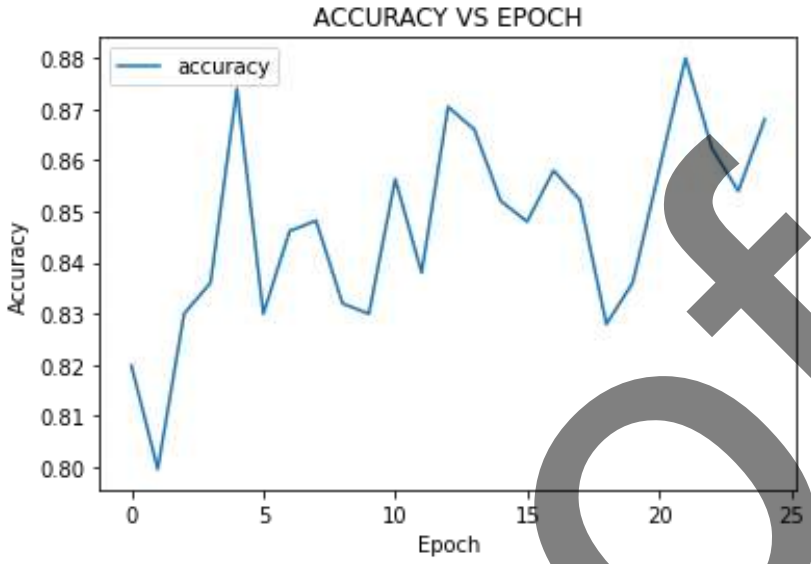

FIGURE 9. Accuracy Vs Epoch for CNN Model

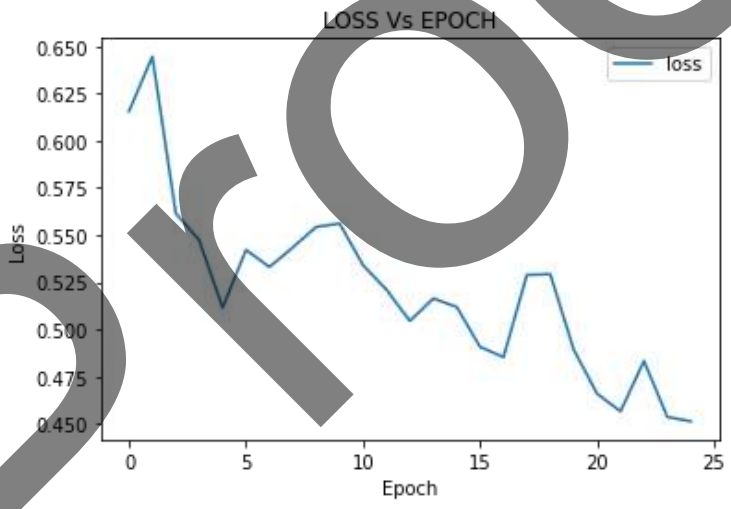

FIGURE 10. Loss Vs Epoch for CNN Model

Similarly, the variation in accuracy for VGG model for 25 epochs is shown in figure 11. From the figure, it can be observed that the accuracy after the end of 25 epochs reaches the level of 87.8%, while loss decreases to 0.02%.

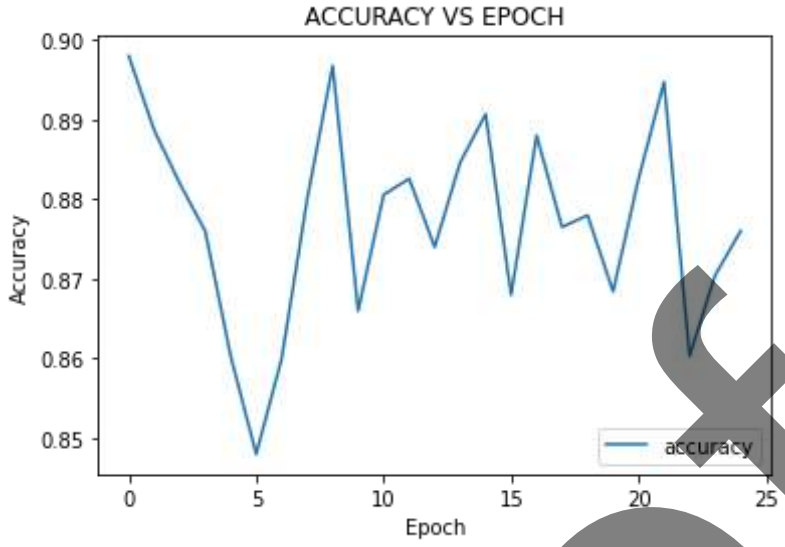

FIGURE 11. Accuracy Vs Epoch for VGG Model

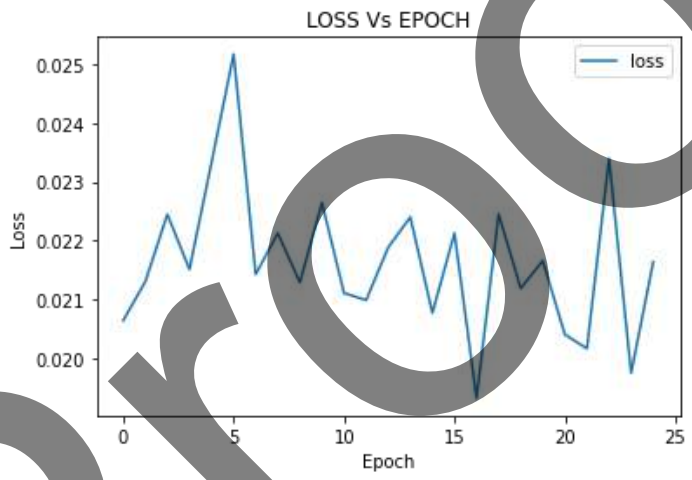

FIGURE 12. Loss Vs Epoch for VGG Model

The comparative analysis of accuracy of both the model is shown in figure 13. From the figure it can observe that VGG16 shows better results against CNN.

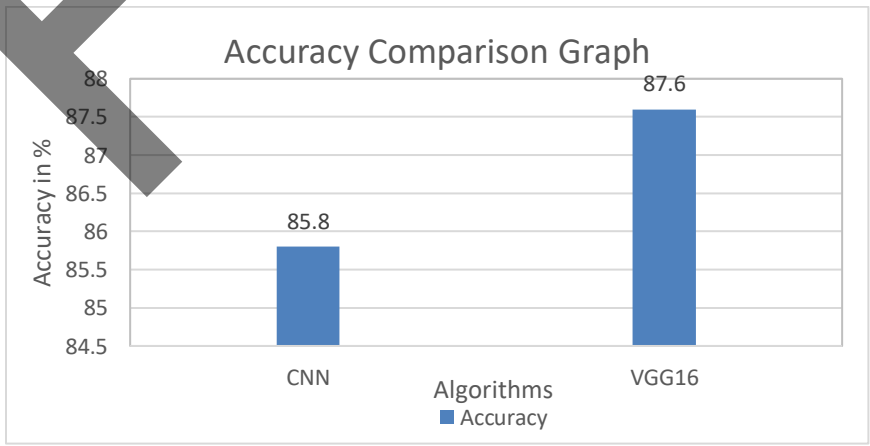

FIGURE 13. Comparative analysis of CNN and VGG16

CONCLUSION

In this paper, we present an automatic and intelligent number plate detection system. The VGG-16 and the CNN method is utilised in order to detect the presence of LP. One forward pass was all that was required for a cooperatively trained network to arrive at the LP. When compared with a network that has two stages, the accuracy of a simultaneously trained network is superior. The entirety of the networks is trained to contribute output in the form of a single model. The proposed method produces superior results in the Number Plate Recognition System, as demonstrated by the comparison of its use with several distinct databases. Images captured in real time are utilised during the testing process. The input image incorporates different ambient conditions. The accuracy achieved by the suggested CNN approach is 85.7%, whereas the VGG model achieves the accuracy of 87.8%.

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ROBOTIC HAND USING SMART MATERIAL: NITINOL

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Abstract. Smart material alloys are researched and used in various applications due to their superelastic, mechanical properties, and shape memory effects. The smart material used in this project is a Nickel-Titanium (Nitinol) alloy. In this study, research is conducted to use Nitinol as a pair of coiled muscles for the flexion and extension - actuation processes and also to check their biocompatibility. The unique arrangement of nitinol springs actuators enables the robotic hand to curl and uncurl its fingers, to hold something. It has a design power requirement of a minimum of 14 watts. The shape setting of nitinol wire of 0.4mm dia to form springs was carried out by firmly constraining it on a mandrel and then performing heat treatment. A series arrangement of nitinol springs along the forearm is implemented into a hand model after deliberation of different designs. Its activation is done using a joule heating approach. Finally, the performance characteristics of these nitinol spring actuators would be compared with the traditional robotic actuators and conclude this study.

INTRODUCTION

In the wake of cutting edge technology and developments in the field of robotics, an important aspect that facilitates the optimum functioning of these robots is its flexibility and smooth functioning actuators. To design lightweight and flexible actuators in the form of artificial muscle using smart material alloy - Nitinol for its actuation purpose has been proposed as a better alternative to conventional actuators in robotics. The most efficacious and extensively used shape memory alloys are nitinol. The Ni-Ti alloys were first used to join two pipes in the industrial sector in 1920. The coupler made of SMA had a smaller diameter than the standard pipes. When the coupler was heated and placed between two pipes, it took on its original shape, and after cooling, the pipes were properly coupled [1] [2]. Nitinol is an intermetallic formed alloy and contains equal amounts of nickel and titanium. Nitinol displays superelastic and shape memory effects due its thermoelastic martensitic transformations [3]. While electric motors are widely used because of their high efficiency and ease of control, they have the disadvantage of being heavier and bulkier than newly created artificial muscles such as twisted and coiled polymer (TCP) muscles and shape memory alloy (SMA) muscles [3]. The application of SMA actuators in many disciplines of robotics, including crawler robots, jumper robots, flower robots, fish robots, walker robots, medical robots, and biomimetic robotic hands have been talked about in various research papers[4]. One of its drawbacks is that they require a long length of wire to produce a significant amount of linear motion, a small amount of absolute force achieved from a single Nitinol wire, a relatively low bandwidth and energy efficiency. A number of SMA-based actuator designs have been proposed for robotic and prosthetic hands. Kathryn J. De Laurentis and Constantinos Mavroidis looked at a device that uses SMA springs in a push-pull configuration. Two motor modules, each having two SMA coil-type springs, were installed inside a finger phalanx during experiments. If the SMA temperature does not exceed a certain point, this actuator can exert a variable force at constant strain. They proposed a SMA actuated micro-joint of a dexterous micro-gripper. The designed micro-joint, which has been integrated into the gripper's phalanx, is made up of a five-link, two-degree-of-freedom planar mechanism activated by two SMA wires [5]. A simple 3D printed soft robotic hand made of PLA (Polylactic Acid) and activated by coiled shape memory alloy (nitinol) muscles is presented in this work along with theoretical ways to enhance the efficiency of the coiled muscle springs.

FABRICATION OF NITINOL ACTUATORS

The process starts with heat treating the nitinol wire of 0.4 mm diameter using the fixture shown in Fig 1 at a temperature of 350°C for 45 minutes in a muffle furnace followed by air cooling of 10 minutes[3]. This fixture helps

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us to gain a shape of spring having 5 mm diameter. The wire is then cut into wire lengths of about 100 cm each into 5 equal parts. This spring now will act as the actuator, with further attachments.

FIGURE 1. FIXTURE ASSEMBLY WITH NITINOL WIRE

WORKING OF ACTUATORS

A Nitinol wire is put through a temperature transformation cycle as shown in Figure 2. The critical temperatures are Ms, Mf, As, and Af with the martensite fraction changing from ξ =0 to ξ=1 where M is referred to as martensite form, A is referred to as austenite form, s is starting point of the process of transformation and f is finishing point of the process of transformation. It may be noted that in the above temperature cycle, no mechanical stress was applied externally. The cycle is completely driven by temperature. Structural fatigue of pseudoelastic Nitinol shape memory wires has been found out by Wagner et al. [6]

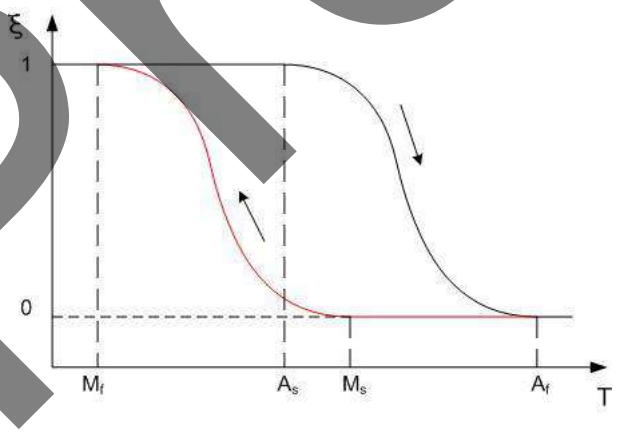

FIGURE 2. MARTENSITE FRACTION IN AN NITINOL WIRE AT CRITICAL TEMPERATURES

The spring formed after heat treatments is about 6 cm solid length, which is then expanded to about 20 cm to increase the pitch of the spring. One actuator spring is divided into two sections, as discussed by Martin Dawson in his thesis [7]. The wire is separated into two parts, 10 cm each, a pivot point at the middle of 20 cm is placed using a nut and bolt and wounding the tendon wire at that point. The pivot point forms the positive terminal whereas the two ends of the spring form the negative terminal, so in short there are one positive port and two negative ports. Each port will actuate that part of the spring to which it is connected. The wires will be heated electrically by the Joules effect as discussed in the paper by C. Zanotti [8]. For flexion of the finger, flexor muscle is actuated i.e spring 1 gets

compressed and pulls the pivot point backwards along with the tendon wire, at the same time spring 2 (extensor muscle) gets expanded. To return the finger the extensor muscle is actuated i.e spring 2 gets compressed and pulls the pivot point towards itself and eventually releases the tendon wire. The mechanism is portrayed in the images below Fig 3, Fig. 4 and Fig 5 respectively.

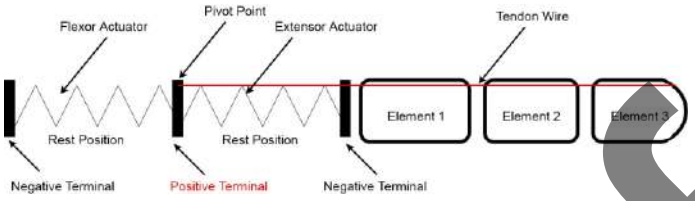

FIGURE 3. NITINOL SPRING MECHANISM (REST POSITION)

As the pivot point moves backward it creates tension in the tendons and pulls the finger backwards. Hence, the flexion of the finger takes place. At the same time when the pivot point moves forward, the fingers get extended. With this two way activation process the time required for deactivation reduces considerably and forms an advantage over other SMA actuators.

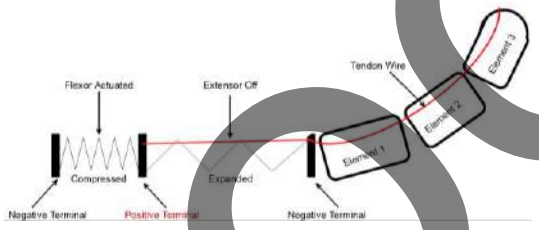

FIGURE 4. NITINOL SPRING MECHANISM (FLEXOR SPRING ACTIVATED)

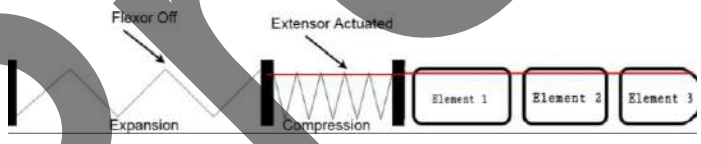

FIGURE 5. NITINOL SPRING MECHANISM (EXTENSOR SPRING ACTIVATED)

PLACEMENT OF ACTUATORS

There are 4 actuators of 6 cm each which will be placed in four fingers (Index, Ring, Middle, Little) and do the work of flexion & extension. There are two other actuators of 3 cm each to be used for the thumb, as the strength and actuation of the thumb has been distributed and hence, the spring of lower length is used. The thumb actuation includes three movements - Flexion, Extension and Abduction. The actuators are going to be placed on the 3D printed Forearm. Six holes were drilled in the forearm to house the six actuators, it is fixed using a long nut and bolt arrangement. Four of the springs in the middle run till the end of the hand making it 20 cm after expansion and two of the springs in the side run till half of the forearm casing and becomes 10 cm after expansion, as shown in below Fig 6.

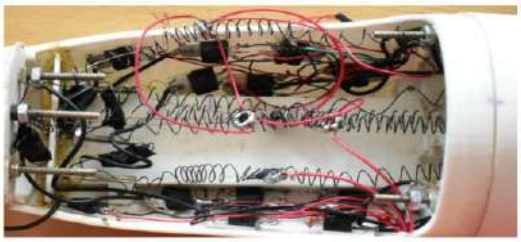

FIGURE 6. PLACEMENT OF ACTUATOR IN THE ROBOTIC HAND

EXPERIMENTAL INVESTIGATIONS

For experimental purposes, The setup used by Annamaria Lisotti in his research paper was used but the current was held constant and the time required was noted to lift varying loads [9]. In the setup, one of the spring actuators is taken and attached to the measuring jaw of the vertical Vernier caliper and the other end is left hanging to be attached with weights as shown in Fig 7 Varying loads are mounted to the second end of the spring with the help of a hanger

FIGURE 7. EXPERIMENTAL SETUP

Both ends of Nitinol wire are connected by using connecting wire on which direct voltage and current supply is regulated and indicated. Firstly 50 grams of weight is applied at 5.5V and 2.5A and elongation of test wire is recorded on the Vernier caliper scale. Same procedure is carried out for other weights at the same current and voltage parameters. The observations are presented in Table 1 below

The amount of current and voltage selected was done after simulation in COMSOL Multiphysics 5.6 software, which will be discussed briefly in further sections. The current was provided using an adapter having the same rating.

TABLE 1. EXPERIMENT READINGS

Weight/ Load	Displacement:- Initial - final Displacement	Time
50 grams	51-26 = 25 cm	5.33 sec
100 grams	55-32 = 23 cm	7.95 sec
150 grams	58-38 = 20 cm	10.95 sec

As the operational condition of nitinol wire includes only in a certain temperature range, it is important to achieve it through varying electrical parameters and time [10]. The previous test also included lower power at the rate of 5.5V and 1A, but the results were not satisfactory as it took more time to recover its shape / lift the load. The test also included using high power rating to actuate the actuator at the rate of 12V and 5A. In this test because of too much heat gained it lost its shape memory effect and eventually had to be heat treated once again. As per all the three tests conducted, only one parameter (5.5V, 2.5A) was holding desired results as per both experimentally and theoretically. Hence, those parameters were selected for operational conditional.

TEMPERATURE ANALYSIS

The softwares used for the research and analysis purposes was Ansys 2022 R1 student version and Comsol Multiphysics 5.6. As due to restriction on the nodes per element on software, we have considered one coil of spring turn into geometry input and done the analysis. One coil of spring included 32 mm of spring wire length. The analysis considered various parameters such as Temperature, Voltage, Current and Stress etc.

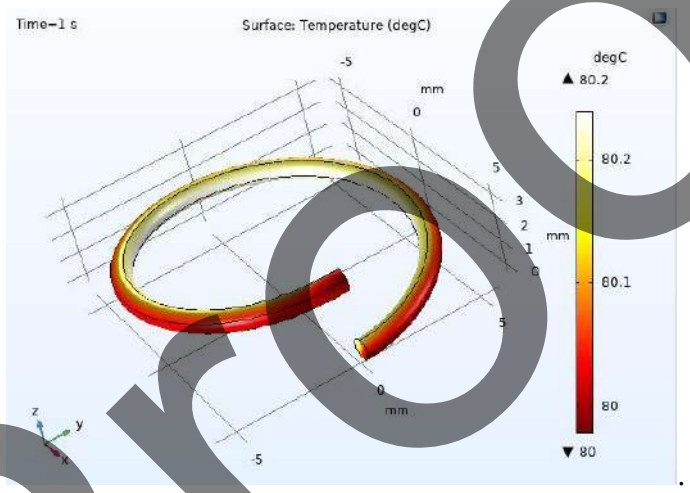

FIGURE 8. TEMPERATURE ANALYSIS

The Fig. 8 represents the temperature change in the Nitinol spring wire on COMSOL Multiphysics software. The test duration was 1 seconds and the parameter used was 5.5 Volts. It was seen that the highest temperature achieved was 80.2^{o}C through simulation. Through practically checking the temperature on the spring using the same above parameter using the thermocouple, a temperature of about 70^{o}C was achieved. The decreased practical temperature value indicates the heat losses taking place and also assuming the ideal condition of material being homogeneous in case of theoretical analysis.

In the following Graph 9 The Y- Axis has temperature in degree celsius and X- Axis has time in seconds. From this graph it is clear that the temperature in the wire spring increases as the time increases as both of them are directly proportional to each other. As the temperature increases stress and strain have been developed in the spring which causes the spring to come back to its martensite state, which was its heat treated state. From the experiments it came to know that it required time to overcome the load attached to it and come back to its original state. It was concluded from a series of experiments that a voltage of 5.5 V for 6 seconds will be sufficient to power one finger.

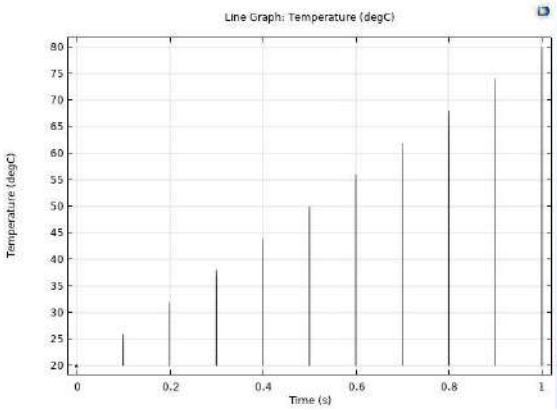

FIGURE 9. TEMPERATURE VS TIME ANALYSIS

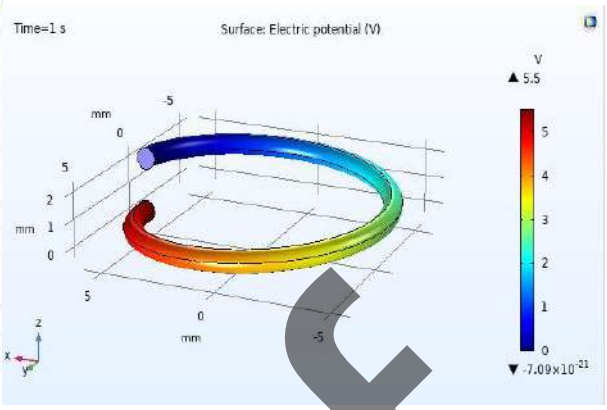

FIGURE 10. ELECTRIC POTENTIAL ANALYSIS

In the simulation portrayed in Fig 10 the bottom end of the spring coil is the source, whereas the upper end of the coil is the ground and the intensity of electric potential goes on decreasing from the bottom end to the upper end. From the graph plotted in Fig 11 it can be seen that the electric potential along the wire is decreasing linearly and gains zero as it reaches the ground. From the experiment it was noted that maximum amount of displacement recovery can be seen on the potential difference source side.

Another simulation was conducted having a spring wire length of 128 mm and passing 16.5 V for 1 seconds. The data plotted in Fig 12 also states that the maximum amount of rate at which the temperature changes though minimal, along the wire length of spring can be seen within 5 mm of spring that is at the source point as well as the ground point. The Fig 13 also depicts the change in temperature along the axis of spring length at the same points, that is the ground and the source.

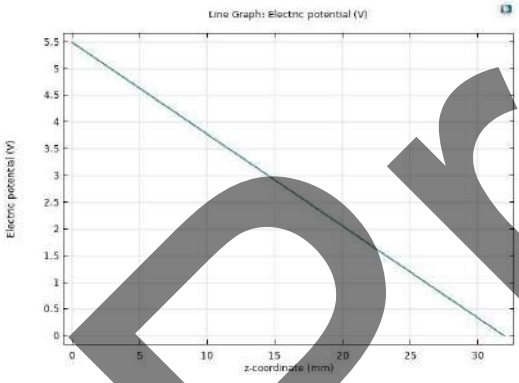

FIGURE 11. ELECTRIC POTENTIAL ANALYSIS GRAPH

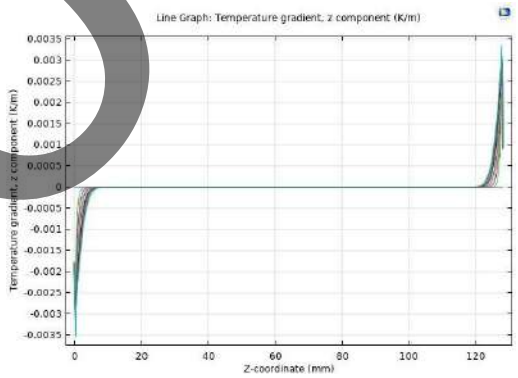

FIGURE 12. TEMPERATURE GRADIENT ANALYSIS GRAPH

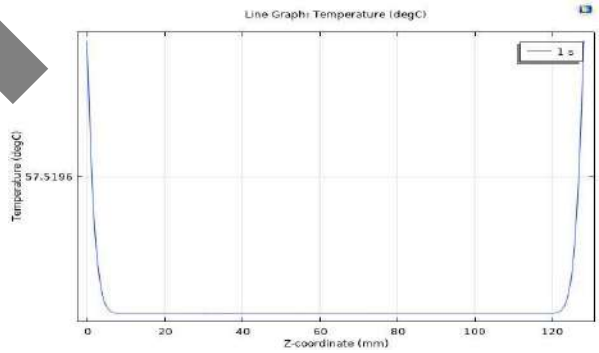

FIGURE 13. TEMPERATURE VS SPRING LENGTH (SINGLE POINTS)

For improving the temperature gain along the wire and to increase the efficiency as well as the shape memory effect of the wire, few simulations were conducted, one of them included having multiple sources and ground in a single spring actuator.

As for doing so, the same spring wire length was taken into consideration and was divided into 4 parts (32 mm each). Instead of providing 16.5 Volts, It was divided into 3 parts as there will be 3 source points, and 5.5V was provided at each of these points. The uncoiled spring image, having 3 sources and 2 ground, taken into consideration for this simulation has been portrayed in Fig 14.

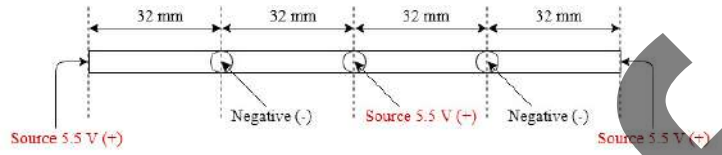

FIGURE 14. UNCOILED SPRING WITH MULTIPLE SOURCE AND GROUND.

From the result it could be seen that there is more temperature gain along the entire length of the wire spring, within the same amount of time and using the same power, but distributed along the entire length, Temperature vs spring wire length has been depicted in Fig. 15. The amount of sources and ground can be depicted easily by knowing the single coil length and the entire length of the spring wire.

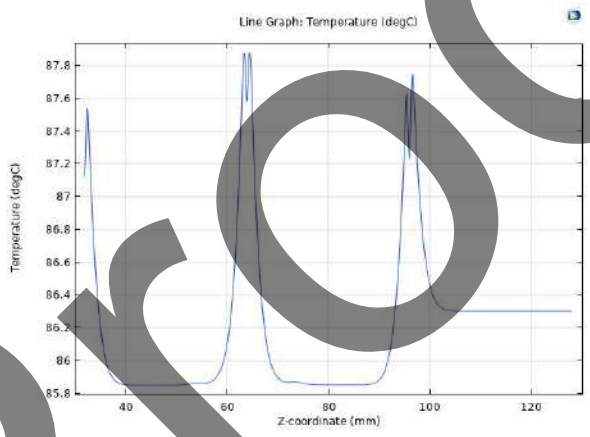

FIGURE 15. TEMPERATURE VS SPRING LENGTH (MULTIPLE POINTS).

Another graph plotted in Fig 16, states that most of the temperature change happens in the mid port terminals, rather than the end port terminals. Though the rate of temperature change in multiple point analysis is more than the single point analysis, the multiple point simulation can be said to be more efficient as the temperature gain is 54 % more than single point simulation.

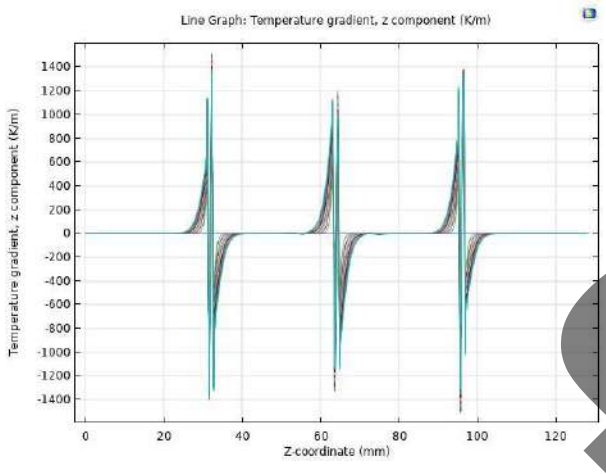

FIGURE 16. TEMPERATURE GRADIENT ANALYSIS GRAPH

For the future implementation it could be stated that after conducting an practical experimental investigation, instead of making just one source and one ground at both the ends, multiple sources and grounds can be added to maximize the possibility of electric potential along the entire length of the wire spring.

LOAD ANALYSIS

Due to the limitation of node per element in Ansys student version software, instead of taking the entire spring into consideration only four coils of the springs were taken into consideration for most of the parameters; it is changing linearly as shown in Fig. 17 In this analysis 0.3 N of weight was added on 1 side and the other was fixed. The maximum, minimum and the average displacement with respect to time was plotted, and the results have been presented in the form of a graph in Fig.18.

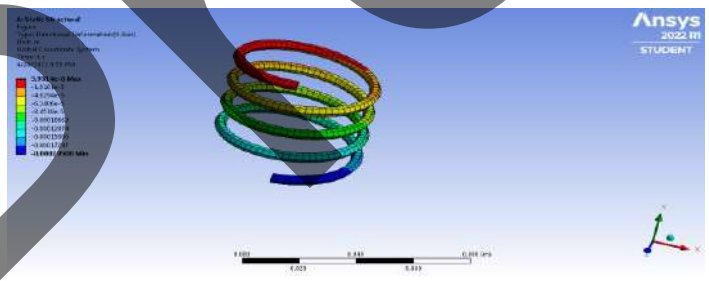

FIGURE 17. SPRING DISPLACEMENT

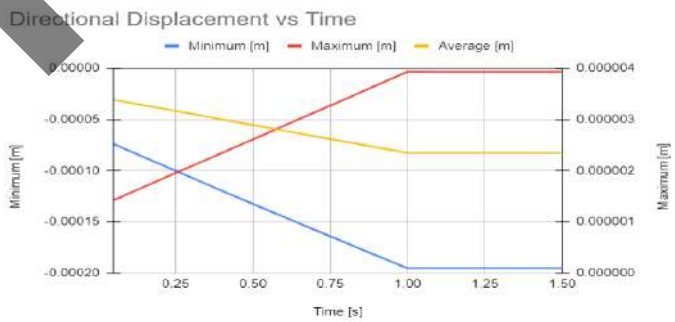

FIGURE 18. SPRING DISPLACEMENT VS TIME

FINGER BENDING ANALYSIS

These are the observed readings for individual finger bending time for the applied power of 13.75 W. From Table 2 we can note that the middle finger takes the maximum response time for flexion and extension movements. Also the thumb abduction movement response time is more than its flexion and extension response time.

COMPARISON OF ROBOTIC ACTUATORS

Table 3 depicts the comparison of nitinol wire used in this project with other traditional actuators. The data is compiled from [11] and nitinol wire properties calculated from experimentations. Specific power (ρ) is the power per unit of weight, σ_{max} is the maximum force applied by the actuator in unit area. Efficiency is mechanical efficiency. f_{max} is the maximum operating frequency.

TABLE 2. EXPERIMENT READINGS

Power applied: 13.75 W	**Thumb**	**Index**	**Middle**	**Ring**	**Little**
Flexion	6.98 sec	13.50 sec	14.33 sec	10.70 sec	7.07 sec
Extension	5.45 sec	3.50 sec	5.62 sec	6.50 sec	5.05 sec
Abduction	14.34 sec	-	-	-	-

TABLE 3. ROBOTIC ACTUATORS COMPARISON WITH APPROXIMATE VALUES [11]

Actuator type	ρ (W/kg)	Efficiency	f_{max} (Hz)	σ_{max} (MPa)
DC Motor	100	0.6-0.9	--	0.1
Pneumatic	4000	0.4-0.5	50-300	0.5-0.9
Hydraulic	1600-2000	0.9-0.98	50-300	20-70
Nitinol (0.4mm dia)	6400-6600	0.527-1.355	0.02-0.07	100-700

APPLICATIONS AND FUTURE SCOPE OF NITINOL WIRES

In future nitinol wires have the potential to be used in the industrial as well as medical sectors with its excellent shape memory actuation mechanism, not only as a spring coil in actuators but also in various structures and forms. Nitinol has already found its place in the medical field by its superelasticity for making braces and has an edge over other braces as it could be reused by Autoclave sterilization with little decrease in its tensile properties [12]. For the future it can also be used in active needles as an actuator to navigate the needle within tissue to reduce the damage in tissues [13]. Nitinol has also started to find its place in the aviation industry as nitinol actuated plain flap wing that will help to reduce the fuel consumption on an airplane [14].

CONCLUSIONS

We were able to build a soft and light weight actuator that could lift 250 times of its own weight in less amount of time by using less voltage. The actuator was successfully implemented in a robotic hand to get the basic motions from it. With more research and more high-grade Nitinol wires, one could surely increase its strength, weight lifting capacity and find more applications of the same.

ACKNOWLEDGEMENTS

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Artificial Intelligence based Analysis of student's involvement in Edtech Industry

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Abstract. The field of eLearning is rapidly developing due to the increasing number of scientific studies that explore new and innovative approaches in the areas of learning and teaching. It is well-established practice in schools and universities that deliver flexible and interactive training using the latest technologies. Informatics is a constantly evolving discipline that presents its theoretical and practical applications in various fields. E-learning is a vital part of the development of educational equity, as it brings together the latest technology and modern education. Due to the increasing number of applications and user groups, it is now more important than ever that the quality of e learning is maintained. Unfortunately, the lack of specific information about students is making it difficult to find the most effective resources. Personalization systems are designed to reduce the complexity of the e-learning process by implementing various techniques and algorithms. Although there has been progress, they still face various challenges such as data-scarcity, scalability, and accuracy. The rise of e-learning has transformed the traditional education industry into a standalone field known as EdTech. Artificial intelligence and machine learning are two of the most promising technologies that can be used in the development of e-learning programs. This paper demonstrates the incorporation of Artificial Intelligence (AI) with e-learning concept.

INTRODUCTION

E-learning is a type of learning system that uses the use of electronic resources such as the Internet and computers. While it can be taught in various ways, such as out of the classroom, the main component of this system is the use of computers. E-learning can also be referred to as a network-enabled transfer of knowledge, as it allows the delivery of education at a variety of times and places. Initially, e-learning was not widely accepted as a form of education due to the belief that it lacked the necessary human element. However, it has become a common form of education due to its high spatial flexibility and technological capabilities. E-learning has also been widely used due to the COVID-19 pandemic[1].

Due to the nature of e-learning, teachers are not able to monitor the progress of their students. This has raised concerns about the quality of the system and the potential impact of it on the students' performance. A study conducted on the prediction of learning performance provides a basis for implementing strategies that can help improve the efficiency of e-learning. Numerous studies have shown that the way students use e-learning affects their learning performance[2]. These studies also suggest that the type of learning they do affect their overall performance.

Due to the increasing popularity of e-learning, the concept of learning performance prediction has gained widespread attention. This method can help teachers identify areas of their students' learning that they can improve by implementing effective strategies. It can also help them start implementing new teaching methods in a timelier manner.

Despite the increasing popularity of e-learning, it is still very expensive to develop and implement it in higher education. Artificial intelligence is playing a huge role in the development of this technology. With the help of deep learning, online learners can now get the most out of their education. The rapid emergence and evolution of ICT has created a variety of new applications for Higher Education[3]. One of these is eLearning, which is a learning management system that enables students to take advantage of the latest technologies to deliver educational content.

One of the main reasons why many people are investing in web-based technology is due to its potential to improve the teaching and learning process. It can also help develop an independent learning environment and foster a deeper understanding of learning. Despite the advantages of e-learning, it is still very expensive to develop and implement it in higher education. This is because it can still pose a barrier to the institutions that can't afford to pay for the initial investment. One of the most effective ways to reduce the cost of implementing e-learning is by repurposing existing resources[4].

As the field of AI continues to develop, new techniques such as deep and artificial neural networks are being developed to improve the performance of machine learning. While machine learning focuses on learning models, deep learning aims to develop systems that can maintain their own representations of the world. Deep learning is a type of

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computer science that uses algorithms to predict the possible outcomes of a given situation based on the data collected by users. It can then be used to automate various tasks and make predictions. One of the most important factors that makes deep learning more intuitive is the amount of information it receives[4].

Our contribution: This paper compares the evaluation of students for e-learning paradigm using various machine learning algorithms.

Organization of paper: Section:1 deals withs the introduction of the paper, section:2 explains the related work , section:3 deals with the e-learning basics with benefit of AI , section:4 discuss the methodology, next section shows the results with various evaluation parameters and last section conclude the paper.

RELATED WORK

Asil Oztekin et al.[5] The goal of this study was to develop a machine learning-based approach to evaluate the usability of an online course using the learning management system, Moodle. The results of the study revealed that the proposed methodology can help identify the most common problems and develop effective strategies to improve the system's performance. The proposed method is very advantageous for improving the usability of a website by selecting the most important checklist items. This method can be utilized to improve the overall performance of a site by taking into account the contributions of these items to its overall usability

Anandhavalli Muniasamy et al.[6].Through deep learning, which is a process that uses machine learning to create new content, organizations can design and implement effective learning programs that are designed to meet the needs of their target learners. This will allow them to improve their performance and acquire knowledge.
HAYATI Hind Through machine learning and natural language processing techniques, we can analyze students' transcripts and classify them into five categories. These include triggering events, exploration, integration, and resolution.

Georgios Kougioumtzidis et al.[7] This study aims to analyze the various applications-oriented models that can be used to predict the performance of end-user (Quality of Education) QoE services in a variety of media platforms. Viet Anh Nguyen The goal of this study was to develop a learning analytics model that predicts the outcomes of a course based on the data collected from students' interactive learning activities. The results of the study revealed that the model's prediction of the students' chances of failing is high, but its accuracy is not ideal.

Khe Foon Hew et al.[8] The goal of this study is to measure the success of Massive Open Online Courses (MOOCs). It aims to identify the factors that influence the satisfaction of students and how these can be used to enhance the brand of an institution.

Sadiq Hussain et al.[9] Machine learning techniques were able to identify students who were prone to performing poorly in certain academic subjects. They were also able to provide effective interventions to help those who were at risk. This method can be used to help students start taking remedial measures early in the academic year. Achieved 95.34% of accuracy with deep learning algorithm

Muhammad Farhan et al.[10] Through the use of IoT-based technologies, students can improve their interactions with their fellows by identifying their strengths and weaknesses. This can be done through the establishment of effective communication infrastructures.

Balqis Albreiki et al.[11] Machine learning techniques are used to develop effective predictions and overcome the challenges related to student behavior. They can also help improve the performance of students by identifying them at risk and predicting their dropout rate. Most studies use datasets from various online learning platforms and student colleges.

Dang-Nhac Lu et al.[12] The goal of this project is to develop a classification model that supports students in choosing the appropriate learning method that is most suitable for their course content. This method can be used to analyze the datasets of previous learners and find out their learning capacity. Obtaining the accuracy of 81% with random forest.

Fidelia Orji et al.[13] The goal of this study was to explore the relationship between student engagement and academic performance using unsupervised and supervised machine learning techniques. The findings indicated that the scores of students on assessments are associated with their academic performance. These are used to measure the effectiveness of the learning process and are also used to evaluate the student's overall performance.

Qingshan Deng et al.[14] This paper aims to provide a framework for developing effective visual attention and participation models for students in online learning. It utilizes machine learning algorithms to classify students' eye

states. The paper shows that the combination of SVM and Gabor achieves the best classification effect. It performed well with a 93.1% accuracy.

Muhammad Farhan et al.[15] presents an algorithm and methodology for analyzing the correlation and covariance between two measures. A software tool has been developed for this purpose. The results of the study are very promising and are interpreted using graphical statistics.

E-LEARNING

Distance education is a type of delivery method that uses a communication network to allow students and teachers to exchange resources. This system is designed to promote collaboration among instructors and students. E-learning is a framework that enables students to complete their education remotely using electronic correspondence. Many universities have adopted this type of learning technology, which can be used in combination with traditional classroom methods. Some of the popular course management software used include Blackboard, WebCT, and Moodle. According to the authors of the literature, e-learning provides a balance between the technological enablers and the acceptance issue[16].

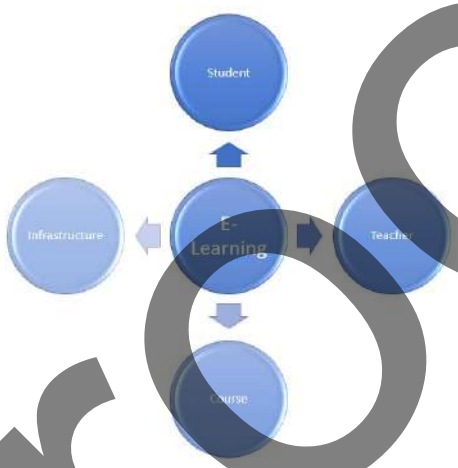


FIGURE 1. Stimulus factor

Although Web 2.0 is a complex concept, it is expected that it will eventually evolve into a framework that focuses more on the learning process. E-Learning 2.0 is designed to help students engage in the learning process. One of the main differences between deep learning and machine learning algorithms is the complexity of the feature engineering process. In deep learning, the process is automated, whereas in machine learning[17], the process is manually carried out. Fig.2 shows the trends of e-learning worldwide.

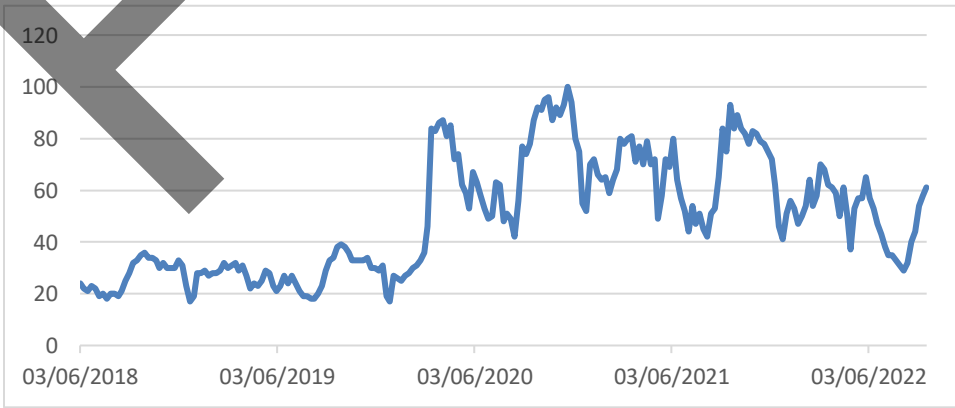


FIGURE 2. All categories e-learning: (Worldwide)

Deep learning is a type of computer science that combines the capabilities of various neural networks and advanced computing power. It can learn complex patterns in large datasets. This type of system is an extension of a traditional neural network.

Benefit of Artificial Intelligence in e-learning

The rapid emergence and growth of online education has made it a growing industry. E-learning is a type of technology that enables teachers and students to enhance their teaching and learning activities. Its main objective is to provide higher education at a lower cost and improve the accessibility of education. e-learning is a type of instructional system that uses a multimedia computer to deliver a learning experience. E-learning provides various advantages to students and teachers. Its main advantage is that it allows them to learn at a shorter time frame and with better interaction with their students[18].

The various advantages of e-learning systems are categorized into six main categories. These include connectivity, which allows students and teachers to access information on a global scale; flexibility, which allows them to learn at any time and place; interactivity, which enables them to assess and engage with their students; collaborative learning, which allows them to work together and share ideas; extended opportunities, which allow them to reinforce and extend traditional classroom learning; and motivation, which allows them to make learning fun[18].

Major benefit of AI

1. **Personalized learning** : The concept of a personalized learning path is a framework that focuses on the learner's specific goals and objectives. It allows them to develop their knowledge progressively through a sequence of courses. The goal of a learner model is to create a personalized learning environment that is based on the various factors that a learner has to consider when it comes to their job roles and learning preferences. This can be done through the collection of various data points and the update of the model's content.
2. **Chatbot** : A chatbot is a type of virtual assistant that can provide a variety of answers and help users navigate through an organization's various resources. It can also be used as a knowledge management tool. An intelligent tutoring system is a framework that combines multiple conversations to help individuals improve their performance.
3. **Performance indicator** : The performance indicator is a tool that can be used to identify the specific learning patterns that are affecting the students' progress. It can also help instructors identify areas of concern and provide suggestions to help their students. In addition, it can help them analyze the data collected by the system.
4. **Improves Accessible eLearning**: AI has made it easier for people with disabilities to access online learning. With the help of this technology, it can perform various tasks such as reading texts, answering voice commands, and converting video to onscreen transcripts.

FIGURE 3. Machine Learning

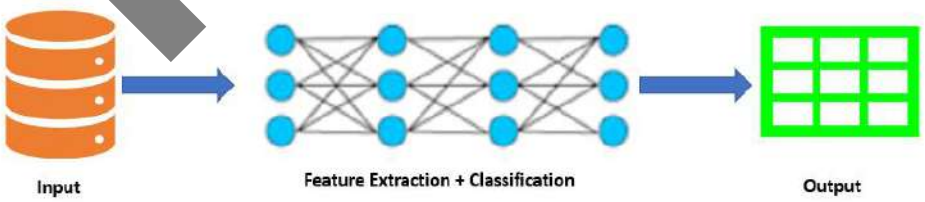


FIGURE 4. Deep Learning

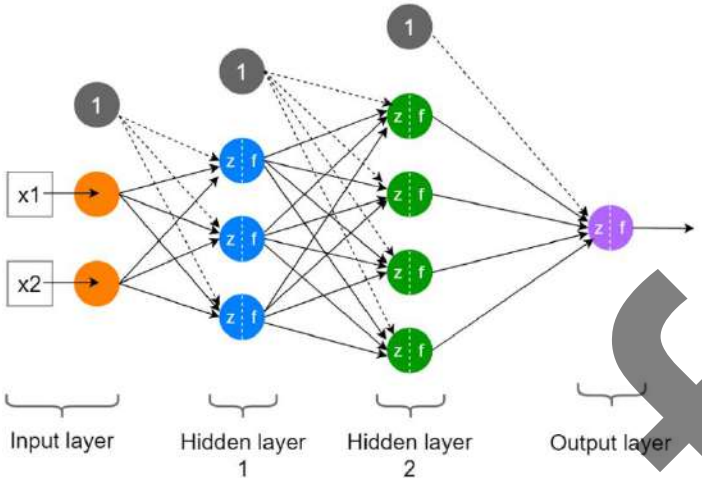


FIGURE 5. Deep neural network with 2 hidden layers[19]

METHODOLOGY

1. **Dataset** : Due to the effects of COVID-19 on students, many universities in Jordan have to deal with various kinds of mental and environmental issues. To gather data on the current state of these students, a survey was conducted online from March to April 2020[20]. After collecting 587 records, the researchers were able to identify the most common issues faced by these students. This dataset aims to collect data on the demographics of students and the perspectives of students on the various factors that influence their decision-making when it comes to using e-learning systems in Jordanian universities.

2. **Machine learning algorithms:**

- Support Vector Machine – SVM or Support Vector Machine is a widely used Supervised Learning algorithm for various kinds of problems, such as classification and regression. It is mainly used in the field of machine learning. The goal of a SVM algorithm is to create a best decision boundary that can be used to classify n-dimensional space into classes. This boundary can then be used to put the new data point into a specific category in the future. SVM takes into account the extreme points and vectors that are needed in creating a hyperplane. These are referred to as support vectors, and hence the algorithm is referred to as Support Vector Machine. In the diagram below, we can see that there are two types of hyperplanes that are classified using the decision boundary.

- **Random Forest** - A random forest is a learning method that involves constructing a large number of decision trees at a time. This type of system can be used for various tasks such as classification and regression. The output of the forest is then used to determine the class of trees that will perform well in the classification. On the other hand, for regression, the average or mean prediction of each tree is returned. Although random forests are generally better than decision trees, their accuracy is lower than that of gradient boosted trees. This is because the data characteristics of these forests can affect their performance.

- **Artificial Neural Network** – The term artificial neural network refers to a type of computational system that's modeled after the brain. It's a biological representation of an artificial intelligence system that's built on the principles of the human brain. Like a human brain, artificial neural networks have neurons that are linked to other neurons in various layers. These nodes are referred to as nodes. An artificial neural network can perform multiple tasks at the same time. Unlike traditional programming, data is stored on the network's whole structure instead of on a database. This ensures that the network can continue working even if multiple pieces of data are lost. Even if the data is not available, the network can still produce useful information. However, it's important to note that the performance of the system depends on the significance of the missing data. To ensure that the network can adapt to the changes, it's important that it has the necessary examples. This can be done by showing the network

the examples that are related to the chosen instances. If the event can't appear in all of the network's aspects, it can cause false output.

- **Adaboost** - AdaBoost is a technique used in machine learning that is designed to enhance the performance of an ensemble method. One of the most common algorithms that is used with AdaBoost is the decision tree with one level that has only one split. These trees are referred to as decision stumps. It can be used in combination with other learning algorithms to improve its efficiency. The output of these learning algorithms is then combined with a weighted sum to produce a final output.

Although AdaBoost is usually used for binary classification, it can also be generalized to other classes or bounded intervals. It is adaptive, which means that it can modify the status of the subsequent weak learners in order to make up for the errors made by previous classifiers. In some cases, it is less prone to getting affected by the overfitting problem. Although there are many weak base learners in a system, the final model can still be considered to be convergent to a strong one if the performance of the individual learners is better than random guessing. In addition to being used to combine weak base learners, AdaBoost can also be used to enhance the performance of deep decision trees.

RESULTS WITH VARIOUS EVALUATION PARAMETERS

1. **MAE** - The mean absolute error is a measure of the difference between the predicted and actual values in a dataset. It shows the average of the residuals within the dataset.

$$MAE = \frac{1}{N}\sum_{i=1}^{N}|y_i - \hat{y}| \text{..... i}$$

2. **MSE**-The mean squared error is a measure of the difference between the predicted and actual values. It shows the variance of the residuals.

$$MSE == \frac{1}{N}\sum_{i=1}^{N}(y_i - \hat{y})^2 \text{.....ii}$$

3. **RMSE** - The root mean squared error is a measure of the standard deviation of the residuals.

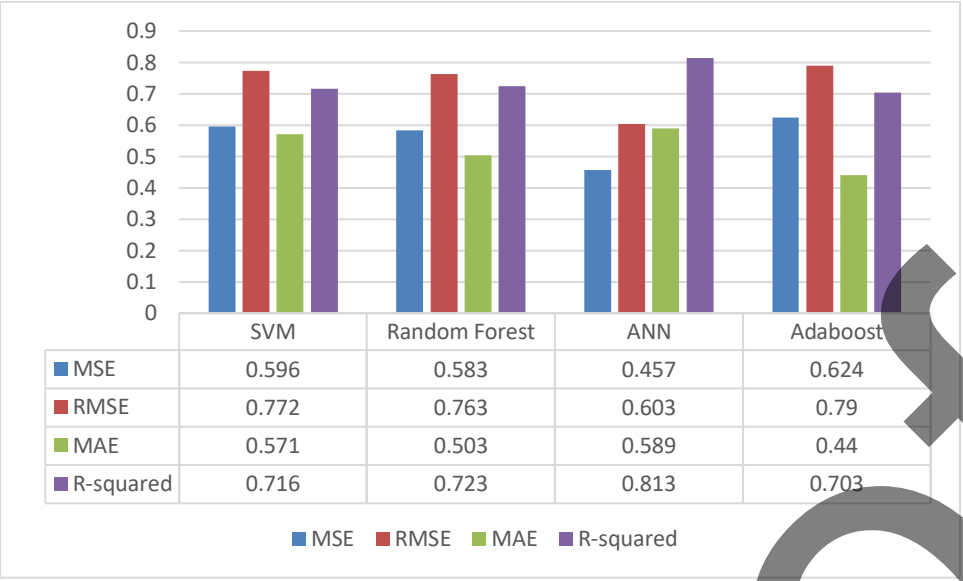
$$RMSE = \sqrt{MSE} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(y_i - \hat{y})^2} \text{.....iii}$$

4. **R-Squared**- The R-squared is a measure of the variance of a dependent variable that is explained by a linear regression model. It can be a scale-free score, regardless of the size of the variable.

$$R^2 = 1 - \frac{\sum(y_i - \hat{y})^2}{\sum(y_i - \bar{y})^2} \text{.....iv}$$

Where $\hat{y}$ = predicted value of y
$\bar{y}$ = mean value of y

The higher value of R-squared and lower value of the three residuals, namely the MAE, MSE, and RMSE, tends to improve the accuracy of a regression model. According to evaluation matrix fig. 5 CNN outperforms with other algorithms



	SVM	Random Forest	ANN	Adaboost
MSE	0.596	0.583	0.457	0.624
RMSE	0.772	0.763	0.603	0.79
MAE	0.571	0.503	0.589	0.44
R-squared	0.716	0.723	0.813	0.703

FIGURE 6. Performance of various algorithms

CONCLUSION

The rise of e-learning has been regarded as a trend in the education industry. It is necessary for students to be active in their learning and develop their skills using technology. This can be done through the use of various learning resources such as videos and books. The goal of an e-learning course is to provide students with a deeper understanding of a concept or a process. This can be done through the use of simulations or by analyzing an argument. In addition to being able to organize materials, smart learning environments should also be designed to improve the efficiency of the program. In addition to being able to provide a personalized learning experience, personal services can also help a student manage their learning. There are various kinds of tutoring techniques that have been studied in order to develop effective and efficient learning systems. Although the various initiatives related to e-learning have been focused on technology, they have also neglected the importance of effective pedagogy and instruction. AI can be used to create new content and improve the efficiency of the program by identifying the needs of the students. This type of learning can be done through the use of design principles and the personalization of the learning experience.

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Error Level Analysis with ConvNet to Identify Image Forgery

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Abstract. The rapid emergence and evolution of AI, deep learning, and machine learning over the last few decades has led to the development of new tools and techniques that can be used to manipulate images very easily. Although these tools have mainly been used in legitimate applications, such as education and entertainment, they have also been exploited for illegal purposes. Videos and audios that are fake or misleading are often used to spread propaganda and misinformation. They can also harass and blackmail people. In image forensics, a process is conducted to identify the manipulations that have been made on a digital image. Due to the availability of low-cost digital cameras, this type of investigation has become more popular. It usually occurs that the images are intentionally manipulated to create false information. Researchers are developing new techniques to identify fake images in digital media, which are commonly used as evidence in court proceedings and in the media. These techniques should also be used to maintain visual records. The goal of these manipulations is to make the image look good before sharing it on social networking sites. However, they can also be very harmful as they can hurt one's reputation. One of the most common reasons why people get identity theft is by impersonation. This occurs when someone tries to access a person's financial and personal information. To avoid situations where the innocent person is accused of committing a crime, law enforcers need to use advanced techniques and tools to determine if the image was manipulated or edited. One of the most important questions that investigators should ask is what parts of the visual image can be manipulated. CNN with loss handling is proposed to perform the extraction of image manipulation using a error level analysis. This method has significantly improved the accuracy of its detection rate by 98.13%.

INTRODUCTION

Due to the rise of technology, the use of images has become more common in today's world. They are commonly used in various forms of communication such as advertisements and publications. The increasing trust in images is also contributing to the rise of their usage. A type of manipulation that involves altering an image's information is called image forgery[1]. This process can be used to check if the image is real or not. Due to the prevalence of image forgery in our society, there has been an increase in the number of people who have become victims. Many of these individuals use software to manipulate images and then use it as evidence in court or on social media platforms. This is why it is important that the images that are shared on social media are either real or fake.

Unfortunately, social media is a great platform for sharing knowledge and socializing, but it can also lead to the creation of false propaganda. Although it takes some practice to get started with photoshop, some of the images that can be manipulated can still appear genuine. Techniques used in forensic photography to examine images require an expert to determine their credibility. This method is usually applicable to a small number of images. However, it is not recommended to use it on large numbers of such as those posted on social media platforms. To avoid this, we need to implement systems that can determine if an image is real or not. With the help of machine learning algorithms, we can make these systems widely available to the public[2].

Due to the increasing number of digital crimes and the diverse methods that are being used to investigate them, the scope of digital forensics has grown significantly. This discipline is a growing body of research that aims to understand the threats that digital media poses and provide mitigation strategies. Another branch of this field is multimedia forensics, which focuses on the study of the facets of data and multimedia. The rise of digital content has become an integral part of people's lives[3]. From mobiles to computers, images are everywhere. They are used in various forms of presentations and are often posted on social media. Unfortunately, the increasing number of digital images has led to the creation of fake news and identity theft. It is therefore important that the development of new methods to detect forged images is carried out.

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Due to the complexity of the task, it is difficult to detect the fake images that are presented in the media. In recent years, various techniques have been developed to classify images into genuine or not. Some of these include the use of spatial operations, texture descriptors, and illuminance quality[4].

The development of computer vision technology has led to the increasing number of models that are trained to detect and generate fake images. This has led to the development of new ways in which people can use their devices and payment methods.

New approaches to detecting forged images are needed. Some of the commonly used techniques include copy-move, object removal, and splicing. Figure 1 shows examples of these manipulations.

Splicing: One of the most common techniques used by image thieves is splicing. It takes multiple parts from an image and pastes them into another one. This is a common type of image forgery. In Figure 1, the sign on the building is cut from another image and added to the original one. Because the regions of the tampered image that are located in other images are easier to detect, spliced images are more likely to be detected. There are also differences between the original and tampered images in various attributes such as lighting, camera reflection, and shadow.

Copy-move: Copy-move is a technique that can be used to hide or misrepresent an image's information. For instance, by adding a region from the same image, the person shown in the figure is added from the original image.

Object removal: An object removal technique can be used to remove unwanted regions or objects from an image. For instance, inpainting can be used to fill in the missing parts of an image.

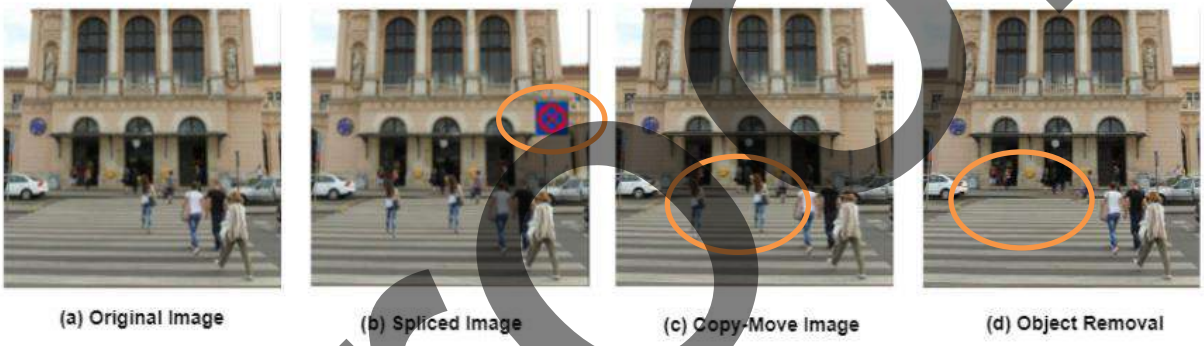

FIGURE 1. Image Forgery Examples : a. Original Image, b. Spliced Image (Adding a sign), c. Copy-Move Image (Duplicating a person), d. Removal (Removing a person) [5]

The main contribution of this paper is to identify the image as real or fake using error level analysis(ELA) with Convolutional Neural Network(CNN) while obtaining the accuracy of 98.13%.

Rest of the paper is arranged as follows Introduction of the paper is deal in section: Introduction, Next section deals with related with, next sections elaborates ELA and CNN, then next section deals about methodology followed by result and discussions.

RELATED WORK

Lin wu et al.[6] present an efficient method for detecting digital forgery takes advantage of the geometric constraints of an image. In the experiments, the proposed method exhibited good performance against both noise and visual representations.

R. Saravana Ram et al.[7] proposed deep learning network that can handle loss handling and manipulation of video and image is proposed by utilizing a pairwise learning approach. This method has significantly improved the accuracy of its detection rate of 98%.

Tao Zhang[8] discuss about the usage of AI mainly used in deepfake detection methods. Also discuss the challenges that need to be solved in order to develop effective and efficient deepfake detection techniques.

Saadaldeen Rashid Ahmed et al.[9] performed analyze of large dataset to detect deep fakes using eight CNN architectures. VGGFace was able to outperform as compared to other deep fakes in terms of accuracy of 97%, area under the curve, F1 score, and precision.

Hao Chen et al.[10] The results of the analysis show that proposed algorithm has good accuracy in identifying objects in the boundary box range and in the two-layer convolution network. This is due to the enhanced features of the W-MRNet feature extraction.

Bhuvanesh Singh et al.[11] develops CNN model takes into account the ELA-generated images to learn more about image manipulation. These images support better learning of such procedures. The EfficientNetB0 was verified against the CASIA 2.0 dataset, which is a subset of tampered images. The efficiency of the program is 87.13%.

Saravana Balaji Balasubramanian et al.[12] is proposed to be used deep neural network for the detection of fake videos and images. It can be performed by analyzing the multiple datasets available in the market, such as Face2Face, FaceSwap, and DFDC. Compared to the traditional approaches, the proposed model has a better detection rate.

Mingxu Zhang et al.[13] proposed a novel method for improving the performance of GAN-based image detection using unlabeled images is introduced. The method utilizes a small number of images to improve the performance of the domain adaptation process. A loss function and self-attention block are also used to improve the efficiency of the domain adaptation process. An unsupervised method for detecting GAN-generated images was proposed. The results of the study show that the proposed method achieves high accuracy with minimal errors.

Kiruthika S. et al.[14] proposed method takes into account the spatial and frequency domain features in order to extract high-quality images. It achieves 99% accuracy when performing various types of experiments on standard datasets.

Moritz Wolter et al.[15] develop a model that can detect synthetic images using wavelet-packet representation. Our approach achieves competitive performance in small network sizes.

ERROR LEVEL ANALYSIS

An error level analysis is performed on the computed artifacts in a digital data file when the use of lossy compression is applied uniformly to a set of data. This method tends to produce uniform levels of compression artifacts. The data may contain multiple parts with varying levels of compression artifacts. The difference between the levels of artifacts in these parts may be caused by the varying types of lossy compression that they have been subjected to. This could mean that the data has been altered. A difference in the data's level of compression artifacts can also indicate that the data was edited. ELA is a method that can be used to detect the manipulation of an image by an advanced image analysis. It does so by re-saving the original compression and evaluating the difference between the original and the ELA representation[16].

Even if the various parts of a composite are matched in terms of compression, the resulting artifacts will vary. For instance, in JPEG, the artifacts produced by the compression method will differ from those produced by the matching components. This method makes the faint compression artifacts more visible by adding a round of lossy compression to the data. The resulting result is then compared with the original data to see if there is any variation. After the difference image has been inspected, the method is referred to as error level analysis. In 2007, N. Krawetz referred to this method as error level analysis. In some digital data formats, such as JPEG, there is a metadata description that describes the type of lossy compression that was used. If the observed compression artifacts are different from the expected results, then the data may have been edited.

Original image ELA result

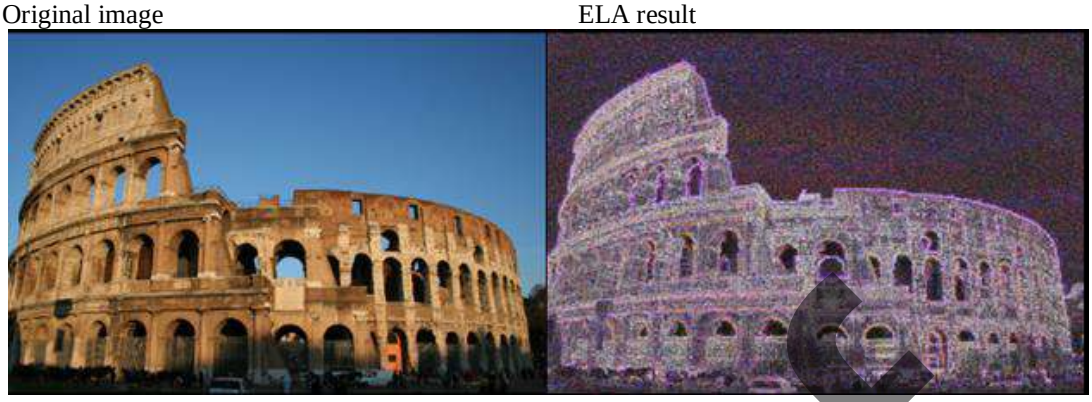

FIGURE 2. Original and ELA image

An error level analysis is a process that can identify the various characteristics of an image based on its lossy image compression. It can be performed in various image formats, such as JPEG. This method is very simple to implement and can be used to highlight areas of an image that have different degrees of compression. Understanding how JPEG format works is important to have a better understanding of its creation process. JPEG utilizes a lossy compression technique, which results in further degradation of the image quality. The algorithm for creating images is based on a grid of 8x8. If the image is not affected by the re-encoding process, then all the 8x8 squares will exhibit the same error level[17].

If an image is saved again, then every square should be reduced to the same level. The original image will be re-encoded at a certain quality level, which results in a known degree of compression. This process is carried out in the ELA process, which is usually performed at 75%. The newly saved image is compared with the original one. Since the human eye doesn't notice a change, the ELA representation will only show the difference between the two files. The resulting ELA image shows the various degrees of compression potentials[18].

CONVOLUTIONAL NEURAL NETWORK

A convolutional neural network is a type of network that can identify visual patterns in images. It is referred to as a mathematical function, and it can be used to express how one function's shape can be changed by another. The output of a computation is computed by taking two images and multiplying them by two matrices. Similar to other neural networks, CNN uses a sequence of convolutional layers to perform extraction. However, due to the complexity of the algorithm, it adds a layer to the equation[19]. CNN's artificial neural networks have been able to perform well in various computer vision tasks. It has picked people's interests in various fields. In fig.2 typical convolutional neural network is composed of several layers, such as the pooling layer, the fully connected layer, and the convolution layer. It learns spatial hierarchies automatically and adaptively using a backpropagation algorithm.

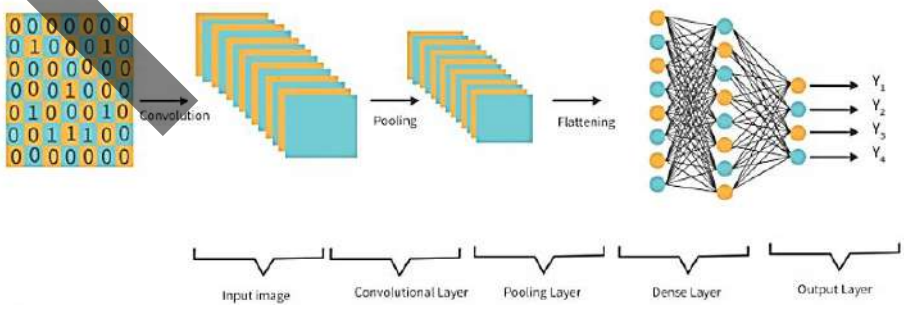

FIGURE 3. Architecture of CNN

The three types of layers that comprise the CNN are the fully-connected FC, the convolutional, and the pooling layers. When these three layers are combined, a CNN architecture will be created. There are also two additional parameters that are related to the creation of the CNN architecture, namely the activation function and the dropout layer.

Convolutional Layer (CONV): The CONV layer is the foundation of CNN, and it is responsible for performing various operations such as the matrix operation. The kernel is a component of this layer that makes vertical and horizontal adjustments depending on the stride rate. Since the image has three or more channels, the kernel's height and width will be modest, but its depth will be wider. Another type of layer that is commonly used in combination with the linear operations of a given structure is the non-linear activation function. This function ensures that the outputs of the various operations, such as the computation of a convolution, are passed through a non-linear loop. Although the functions of the hyperbolic and quasi-linear types of activation were previously used, they have since been replaced by the rectified linear unit.

Pooling Layer (POOL): The pooling layer is designed to reduce the dimensionality of the data by minimizing the amount of computational power required to process it. It can be divided into two kinds: maximum and average pooling. The former allows the user to get the maximum value from the area of the kernel that's covered by the pool, while the latter returns the average of all the values in that part of the image.

Fully Connected Layer (FC): The FC layer is fully connected, and it works by having a flat input, which means that each neuron is connected to its corresponding input. After that, the vector is sent via a few FC layers, which are usually used for performing mathematical functions. If there are FC layers in a CNN structure, then the classification procedure begins.

Activation Function: The last fully connected layer's activation function is often different from the others. Each activity requires the selection of a suitable activation function. For multiclass classification problems, the softmax function is used to target class probabilities. It normalizes the output values from the last connected layer to provide a representation of the class probabilities.

Dropout Layers: The Dropout layer is a mask that prevents some neurons from contributing to the next layer while leaving all the others unchanged. It can be applied to the input vector to nullify its properties, but it can also be used to remove hidden neurons. One of the most critical components of CNN training is the dropout layers, which prevent overfitting. Without these, the first batch of data has a significant impact on learning. This is because learning of certain traits that occur only in later batches or samples would be prevented.

METHODOLOGY

DATASET

The CASIA dataset[20] contains various types of image tampering, such as copy-move and heterologous splicing. To ensure that the image is genuine, the data was carefully selected and applied various post-processing techniques, such as blurring and filtering. The CASIA dataset is split into two parts: the first one is known as CASIA 1.0, while the second one is known as CASIA 2.0, for testing. Since the first one doesn't provide ground truth, we use the second one for training.

This dataset contains over 920 forgeries that were made using Adobe Photoshop CS3. All of the images are in a JPEG format.

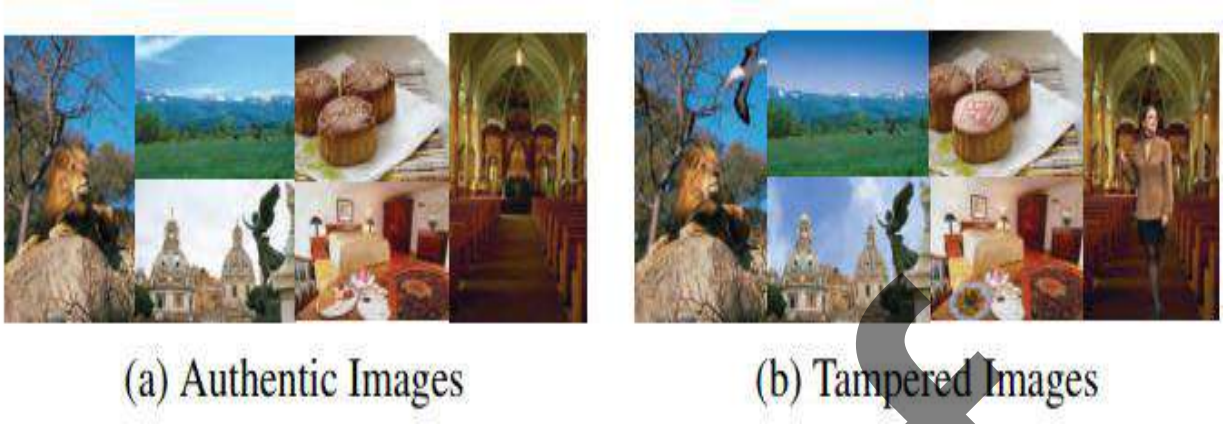

FIGURE 4. Sample image from CASIA

Dataflow and workflow of the model

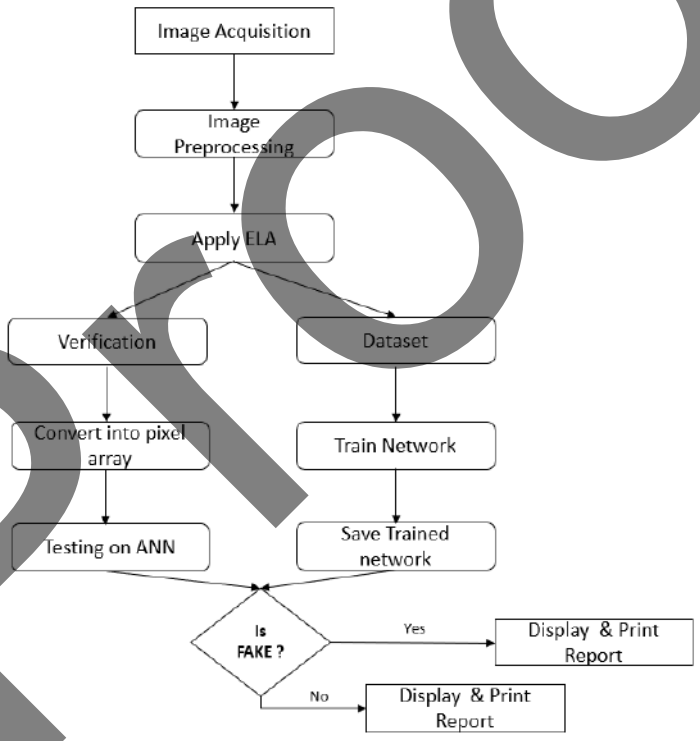

FIGURE 5. Dataflow

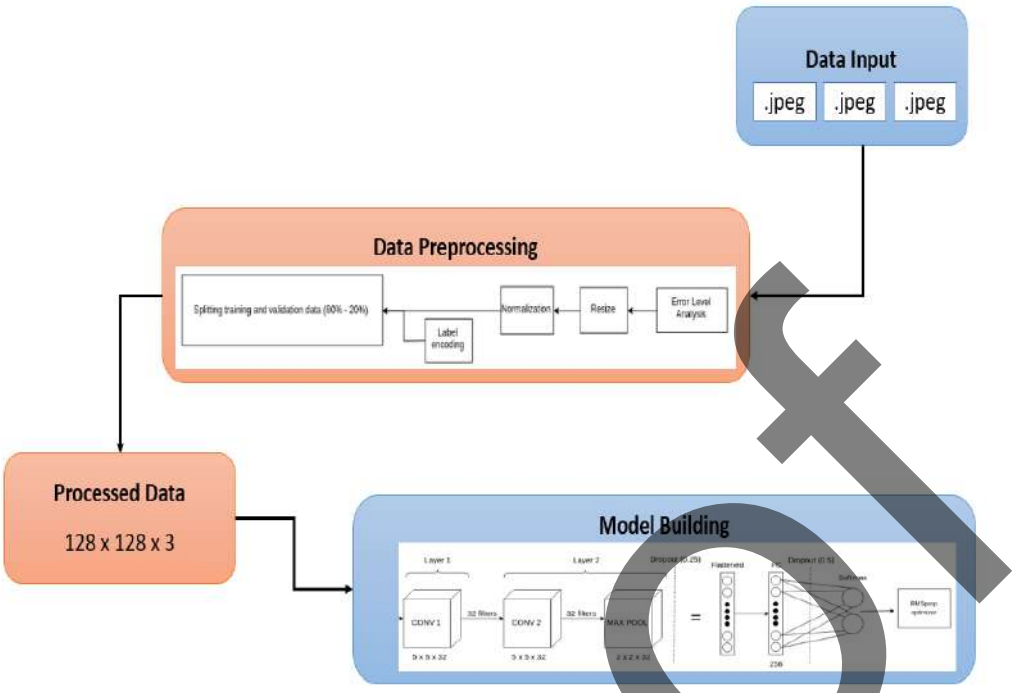

FIGURE 6. Workflow of the model

LOGLOSS

A loss function is a statistical measure that compares the predicted and the target outputs of a training program. It takes into account the performance of the neural network in training. The loss function is performed with a set of hyperparameters that are adjusted to minimize its average loss. The hyperparameters are adjusted to reduce the average loss. They are then used to find the weights (w^T) and biases (b) that minimize the average loss (J).

$$\boldsymbol{J(W^T, b) = \frac{1}{m}\sum_{i=1}^{m} L(\hat{y}^{(i)}, y^{(i)})} \ldots\ldots\ldots \text{i}$$

$$\boldsymbol{Log\ loss = \frac{1}{N}\sum_{i=1}^{N} -(y_i * log(p_i) + (1 - y_i) * \log(1 - p_i))} \ldots\ldots\ldots \text{ii}$$

where,

$\boldsymbol{y_i}$ is ith label and $\boldsymbol{p_i}$ is the ith predicted probability.

RESULTS

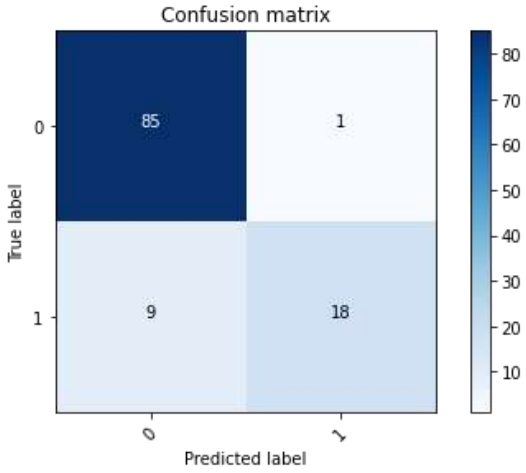

FIGURE 7. Confusion Matrix

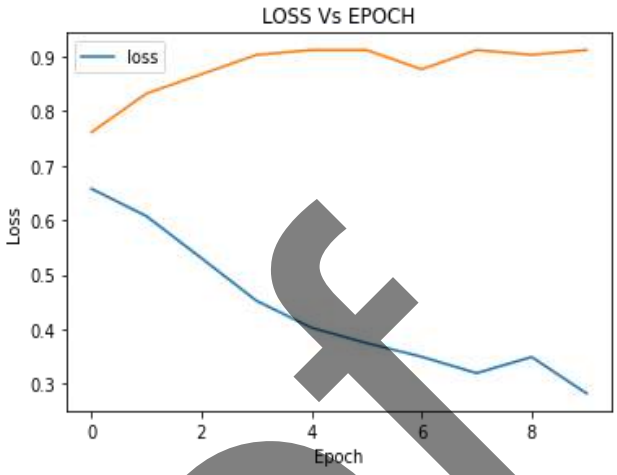

FIGURE 8. Loss vs Epoch

A confusion matrix is a table layout that shows the performance of an algorithm in terms of statistical classification fig.7 shows the confusion matrix with true label and predicted label. The matrix shows the instances of a given class in a row while the column shows the instances of a predicted class. The name of the system is derived from the fact that it can easily identify if the system is confusing two classes. A contingency table is a type of table that consists of two dimensions, namely, actual and predicted. It also has identical sets of classes.

In fig.8.the continuous decrease in training loss and validation loss is a sign that the model is getting closer to its convergence. However, it seems that the model started to over-fit as its loss stopped decreasing after a certain number of epochs.

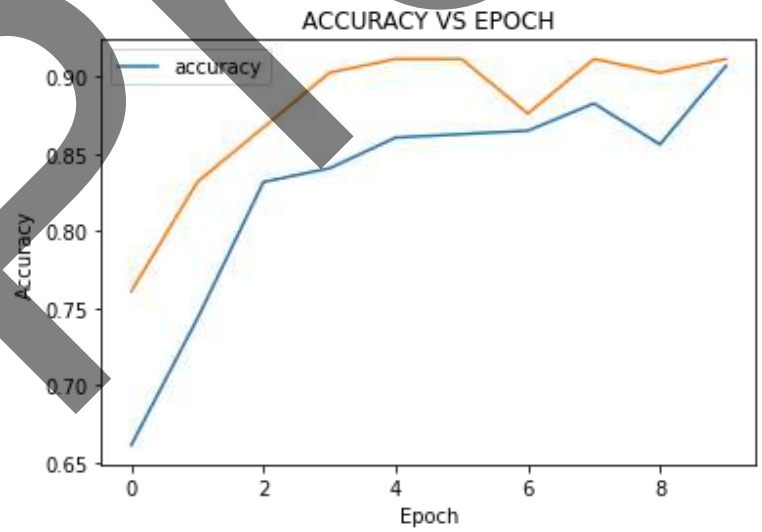

FIGURE 9. Accuracy vs epoch

The continuous improvement in the fig. 9 of the model's training and validation accuracy is a clear indication that the model is improving and attained the accuracy of 98.13%.

DISCUSSION

The proposed model was able to achieve promising results on standard datasets. The main components of the model are the Convolutional layers, which are used to generate feature maps for various tasks such as segmentation and image classification. ELA uses CNNs and aims to improve its performance if the data is provided with enough. The proposed model can be used to classify different types of fake image efficiently. The proposed system achieved the accuracy of 98.13%.

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Privacy Preservation In Digital Platforms through Anonymization Technique

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Abstract. Anonymization is a helpful privacy protection approach that is applied in a range of technological domains, namely data gathering, cloud storage, and big data, to secure extremely sensitive data from access by third parties. As both the quantity and the quality of data produced in the modern world continue to expand, the need to safeguard it against any and all hazards is growing more pressing. The primary objective of this study is to offer a concise introduction to various methods of data privacy protection and differentiated privacy protection. A new k-anonymous solution that is distinct from the standard k-anonymous approach has indeed been proposed in order to solve the concern regarding the protection of personal information. In this article, a novel clustering technique is proposed as a means of achieving k-anonymity through increased efficiency. The vast majority of clustering methods require additional processing in order to analyses data. Nevertheless, the software will generate an improved clusters array in the event that the found initial centres are consistent with the data arrangement. Our study has developed a method, which is centered on the Dissimilarity Tree, for locating a more reliable initial centroid, as well as a cluster that is marginally more accurate while requiring a smaller amount of processing time and NCP. According to the graphical representation of the results, the overall information loss caused by the anonymized dataset is around 20% less on average than that caused by other procedures. In addition to this, it is successful with numerical as well as category attributes.

INTRODUCTION

The majority of the value that may be derived from this data has not yet been used, despite the fact that businesses now have access to customers' personally identifiable information and utilise it to improve customer service and their decision-making processes. Because it may assist third-party researchers and scientists in solving challenges relating to themes as diverse as the design of neighborhoods and the investigation of disease. A great number of organisations are enthusiastic about the prospect of exchanging this information while yet protecting the personal privacy of individuals. Nonetheless, in order to get reliable results from the analysis, it is necessary to keep the data's utility intact.

The owners of the data wish to find a means to convert an extremely sensitive information into a low-risk, private information set of data that they are able share with anybody and everyone, including researchers and commercial partners. On the other side, organisations are gradually disclosing databases that they thought had been anonymised, only to find out that a significant number of the records have been re-identified. This is a problem since it makes it easier for people to steal sensitive information. It is of the utmost importance to have an understanding of how anonymization tactics work, where and when they can be used properly, as well as the benefits and drawbacks associated with using them.

This article provides a description of the privacy method known as k-anonymity, which is widely utilised to protect the confidentiality of people in a variety of settings. It covers the sharing of data as well as the advantages of applying k-anonymity to data that has already been anonymized. K-anonymity is a method of protecting one's privacy that has become increasingly popular in recent years and is used frequently in settings that involve data exchange. The eventual goal of many different privacy-preserving technologies is to provide data subjects with anonymity. When viewed at face value, anonymous simply implies not being identifiable. However, upon closer inspection, it is discovered that deleting names from a dataset is not sufficient to create anonymity. It is feasible to re-identify data after it has been anonymized if the data in question is compared to another dataset. Data containing relatively non-identifiers, which are pieces of data that are not key differentiators but can be employed to re-identify people, have the ability to re-identify people. These can be used to re-identify people. Data that contains quasi-IDs, which are snippets of data that do not act as unique identifiers but can be linked with other datasets to distinguish individuals.

K-anonymity is a fundamental concept that was established to prevent anonymized data from being associated to other data and re-identified. K-anonymity was developed in order to prevent re-identification of the data. This was accomplished through the development of k-anonymity. K-anonymization is a very effective method provided that it is utilised appropriately and the necessary safeguards are in place. These safeguards include network access and

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contractual protections. It is an essential component of the armory of privacy-enhancing technologies, alongside other approaches like differentially private algorithms. We are observing an increase in the data dimensionality as well as a growing number of accessible to the public datasets that can be of assistance in the process of re-identification as big data moves from being the exception to the rule.

According to the findings of a study, the bulk of traditional approaches to k-anonymity make use of generalization and suppression strategies. Each of these result from a significant level of information loss because a large portion of their functionality is based on ordering relations that are generated from predetermined abstraction layers that are applied to the attribute domains. Because of this, the outcomes of anonymization frequently lead to a significant loss of information and, as a consequence of this, limited availability. In addition, the present algorithms for anonymization focus exclusively on protecting the information confidentiality while ignoring the benefits that can be derived from anonymized data in a practical setting. As a direct result of this, there is a dearth of anonymized data in the circumstances that occur in the real world.

An upgraded k-anonymity privacy protection technique that uses clustering has been suggested here. In addition, a great amount of attention was put into improving the clustering process so that it would be better suited for data secrecy conditions. This was done in order to make the procedure more appropriate overall. When it relates to clustering, picking optimal parameters that seem to be consistent with both the architecture of the data can lead to the generation of a more useful collection of clusters. When it comes to clustering, you will have the best chance of success if you are able to locate early centroids that are in alignment with the data set. With a smaller amount of computational time, as well as the suggestion of a strategy that is based on the Dissimilarity Tree, it is possible to locate both of the quickest and most effective centroid and each little higher accurate cluster. The following is a list of some of the primary principles of k-anonymity. The following are several fundamental ideas behind k-anonymity.

K-ANONYMITY

K-anonymity The database is said to be K-anonymous when attributes are either removed or simplified to the point that each entry is identical to at least k-1 other entries in the database. As a consequence of this, K-Anonymity stops definite database links from being created. The use of K-anonymity helps to ensure that any information that is shared is accurate. Two methods, generalization and suppression, are highlighted as key components of the K-anonymity concept. [2] When micro data is shared, it is common practice for data holders to remove or encrypt explicit identifiers such as names and the social security numbers in order to protect the identity of respondents. On the other hand, removing identifying characteristics from data does not ensure complete anonymity. Other information, including such birth date, sex, and ZIP code, is frequently included in the information that is given. This data can be linked to data that is publicly available, which allows one to re-identify responders and infer information that was not intended to be shared. One of the new notions in micro data protection is called k-anonymity. This recently proposed characteristic encapsulates the security of a micro data table against the probable re-identification of the responders to whom the data pertains. According to the K-anonymity principle, each tuple in the microdata table that is disclosed needs to be indistinguishably related to at least k different respondents. The relationship that k-anonymity has to data protection measures that guarantee the accuracy of data is one of the most intriguing characteristics of this type of anonymity. The first attempt to preserve users' privacy during data mining consisted of introducing noise into the input (the data) prior to its being processed. The perturbation strategy suffers from the drawback of lacking a formal foundation, which makes it difficult to verify the degree to which one's privacy is protected. Concurrently, a second subfield of privacy-preserving data mining that makes use of cryptographic methods was established. As a consequence of this, it is not capable of providing a full answer to the challenge of ensuring the protection of individuals' privacy when data mining. One concept of privacy, referred to as k-anonymity [3,] has made significant headway in the public sphere, and it is currently supported by legislators as well as corporations. K-anonymity guarantees that no one will be able to recognise you.

DATA RE-IDENTIFICATION ATTACK

The information compiled for each voter comprises their name, address, date of birth, and gender, as seen in the circle on the far right of Fig 1. This information can be linked to medical records by using ZIP codes, birth dates, and gender. This makes it possible to link diagnoses, procedures, and medications to particular individuals. For instance, at the time in question, William Weld was serving as the Governor of Massachusetts, and the GIC database contained information regarding his medical history. The former Governor of Massachusetts, William Weld, called Cambridge,

Massachusetts home. In accordance with the Cambridge Voter list, there were only six other people with his birth date, three of whom were guys, and he was the only one in his five-digit ZIP code. Additionally, three of the six people with his birth date were men.

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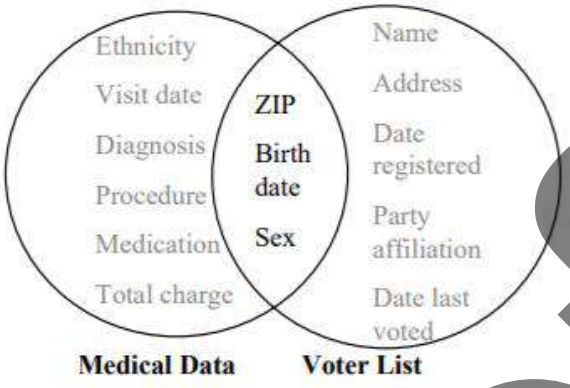

FIGURE 1. Data Linking by Re-identification

The example that was just presented shows how re-identification can be accomplished by directly connecting (or "matching") on comparable properties. The research presented in this paper demonstrates that one strategy for thwarting an attempt of this kind is to alter the information that is provided so that it maps to a large number of people and, as a result, makes the connection less clear. When there are more candidates to choose from, the relationship between them gets less clear, and as a result, the data become more anonymous.

PROPOSED CONTRIBUTION

- To make available as much data as possible so that it can be utilised by a variety of organisations for purposes linked to either business or research.
- In the process of clustering, the Dissimilarity Tree technique will be used to select the centroid.
- To protect the information from being inferred upon or attacked in such a way that the privacy of no individual is compromised as a direct result of the distribution of the data.

RELATED WORK

The re-identification of the edX data collection for the 2013-2014 school year resulted in significant improvements to the data set, as stated by Darieset al. [4]. These improvements included adjustments to the characteristics and grade distribution of students who successfully finished the course. In the follow-up study that was conducted on the edX data set in 2015, Angiuli et al [5] discovered that anonymization techniques that rely heavily on suppression skew column values, whereas anonymization techniques that rely heavily on generalisation skew column correlations. According to their research, high-achieving kids have uncommon qualities that can be used to identify them, which makes it more likely that high-grade records would be covered up.

In their research, G.Ghinita, Y. Tao, and P. Kalni discuss the concept of l-diversity [6]. Let's say you have a collection of k separate records, each of which has a unique quasi-identifier associated with it. This is advantageous since it prevents an adversary from using the quasi-identifier to determine who the individual is. But what if the value they're seeking for (like a person's medical diagnosis, for example) is included in every single value in the group? The dispersion of desired characteristics across the members of a group is referred to as "l-diversity." The generalization-based and permutation-based tactics are the two types of l-diversity methods that are currently accessible. An approach to generalisation that is currently in use separates the data into separate groups of transactions. Within each of these groups, there are sufficient records that contain l-different sensitive items that are represented adequately.

The practice of generalisation, in which quasi-identifier values are replaced with values that are less particular but semantically comparable, is an example of a common anonymous approach. Then, in the QID space, all of the

quasi-identifier values that are associated with a group would be generalised to the complete group extension [7]. If at least two of the transactions in a grouping have different values in a column (meaning that one of the transactions contains an item while the other does not), then the current group will lose all of the information that it previously had about the item. The QID used for this stage incorporates each and every prospective item that is recorded in the log. Any approach of generalisation is likely to result in highly large information loss as a consequence of the enormous dimensionality of the quasi-identifier, which contains thousands of potential items. As a consequence, the data will become worthless [6]. In order for generalisation to operate, the records in the same bucket need to be somewhat close to one another. In that case, far too much information would be lost during the process of combining the records. However, in high-dimensional data, the majority of the data points are located at distances that are comparable to one another. Because no other allocation presumption can be justified, the data analyst is required to adopt the uniform distribution assumption, which states that each value in a generalised interval or set has an equal chance of occurring. This is necessary in order for the data analyst to be able to perform data analysis or data mining operations on a generalised table. As a consequence of this, the generalised data lose much of their usefulness as a source of information. Because each feature is generalised on its own, correlations between a number of different attributes are also lost in the process. When investigating attribute correlations on the generalised table, the data analyst needs to keep in mind that any possible combination of attribute values is a distinct possibility. This is an issue with generalisation that is inherent to the situation, and it prevents proper attribute correlation analysis.

Pierangela Samarati and Latanya Sweeney [9] explore the challenge of releasing data connected to a person, also referred to as person-specific data, while maintaining the confidentiality of the individuals to whom the data relate. The concept of k-anonymity serves as the foundation for their strategy. The table is said to give k-anonymity if all attempts to connect specifically identifying information to its contents result in an uncertain mapping of the information to at least k individuals. They show how generalisation and suppression methods can be used to achieve k-anonymity. [Citation needed] Additionally, the principle of minimal generalisation is put into practise. This principle defines the quality of a release procedure as one that does not alter the data any further than is required in order to achieve k-anonymity. Additionally, there are recommended preference principles that can be used when choose amongst a number of different restricted generalisations. In the end, the scientists presented not only an algorithm but also the experimental findings that were produced when the system was used to generate actual medical data releases from the real world.

Sweeney et al. [10] recommended using k-anonymization, which is one of the well-studied strategies of privacy-preserving data mining. K-anonymization is used to protect users' identities while still mining data. This strategy advises that the values of the public attributes be generalised in such a way that each published record becomes indistinguishable from at least k 1 other records when it is projected on a subset of the public characteristics that are part of the public attributes. As a consequence of this, it is possible to link each individual to a collection of records included within an anonymized table that has been made public and has a size of at least k. This affords some measure of protection for the individual's right to privacy.

Meyerson and Williams [11] investigated the problems and carried out research based on the hypothesis that the table entries ought to be allowed to remain as they are or eliminated totally. In this configuration, the cost function that should be minimised is the total amount of entries in the table that have been eliminated. They did this by establishing a reduction, which is how they established that the k-dimensional flawless matching issue is an NP-hard problem. They developed two approximation algorithms: one that runs in O (n2k) time and achieves an approximation ratio of O(k ln k); and another that runs in O (n2k) time and guarantees an approximation ratio of O(k ln k) (k ln n).

The purpose of Li, N. et al [12] research is to narrow the gap by analysing different k-anonymization strategies and demonstrating that none of them are able to prevent a repeat recognition assault. Following the conclusion of the trial, the study will suggest an alternative method for dealing with the production disturbance. It is possible to achieve differential privacy at the beginning of the process by using random sampling, and then to fine-tune the effects such that they archive a high layer of privacy using this method. The analysis is susceptible to a re-identification attack as a result of the random sampling that was performed. The work is entirely devoted to discussing output interruption (i.e. added the random sampling is after query results). Given that random sampling is typically used to enhance an algorithm's privacy and that its application can be broadened to cover anything, The interruption of production is the lone topic that will be discussed in depth throughout this article (i.e. added the random sampling after query results). It is possible to use random sampling to the input disturbance in the same way that it is used to improve the algorithm's level of privacy. The interruption of production is the only topic that will be discussed in this paper. In order to improve the confidentiality of algorithms, random sampling is often employed to both interrupt the data inputs and generate new data in the process. In order to provide an adequate level of protection for individuals' privacy during the process

of publishing microdata, the privacy gap must be kept to a minimum. Utilizing the author differential privacy in a way that is both effective and efficient enables us to easily meet all the requirements for random sampling. Various other ways available. Other methods that have not been put through any kind of evaluation yet. For the aim of addressing the demands of the Member States, additional approaches that are not discussed in this article may be utilised.
F. K. Dankar et al. [13] examine some of the practical challenges that arise when applying differential privacy to health data. These issues include: In addition to this, they proposed a model for doing data analysis on healthcare using differentiated privacy. The research investigates an attempt to re-identify a patient based on personal information taken from their medical records. The authors suggest that unique factors need to be explored in addition to the disclosure of health-care data, which is also required. In the event that this is finished, additional approaches for imposing differential privacy could prove to be fruitful. The re-identification attack is mentioned in the study, but there is no in-depth discussion on how to protect yourself from it.

Friedman, A., and Schuster [14] find a solution to the issue by employing the Data Mining-Decision Tree algorithm in order to concurrently comprehend the nature of the programme as well as the privacy concerns associated with it. With the improved method, a smaller number of learning samples need to be tested in order to reach a greater level of confidentiality and precision in the data. After the experiment has been carried out to its conclusion, there is a significant amount of variance in the data. Other stopping rules were offered by the reviewer, however in this particular study, those laws were not empirically tested. The text does describe an auxiliary assault; however, it does not go into detail regarding how this assault was prevented.

Their research indicates that a number of organisations have made publicly available considerable micro data. Simi, Ms., Nayaki, K., and Elayidom, M[15] are all employed in business and research-oriented fields, and they take part in the processing of data and the provision of cloud services that involve quality data. It does not include overt identifiers such as a person's name or address, but does include private information such as date of birth, postal code, sexual orientation, and marital status. This information can be coupled with other publicly available data to help identify an individual. This kind of participation attack has the potential to access certain personally identifiable information that is stored on the social networking site, putting a person's privacy in jeopardy in the process. K-anonymization is a method that prevents assaults like these by randomly modifying the micro data. K-anonymization is a method that replaces micro data in order to protect against assaults of this nature. Finding an acceptable method to anonymize data in light of the possibility of collecting additional data would be challenging. The author presents three of the most effective algorithms, along with an analysis of their performance and how well they work, after conducting a number of research and analysing them in a systematic way. Studies can be used by researchers to evaluate the connection between k values, anonymization levels, quasi-identifying selection, and the amount of time it takes to carry out an operation.

PROPOSED SYSTEM

SYSTEM ARCHITECTURE

The suggested architecture for the system is displayed below in Figure 2. After the initial step of taking the input dataset and applying the preprocessing step, the next step is selecting the k-anonymity attributes, and if an attack on the dataset has not been detected, the dataset is considered to be valid. If an attack has been detected, however, attack prevention techniques must first be applied, and after that, dissimilarity tree centroid selection must be performed. After that, the clustering and K-anonymity-based data production steps are carried out, and finally, the evaluated graphs are presented.

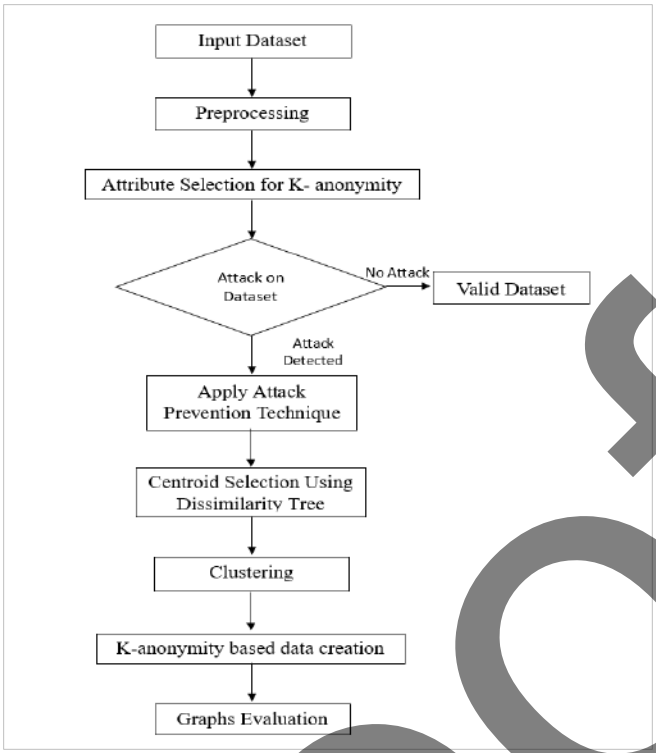

FIGURE 2. System Architecture

ALGORITHM

Algorithm 1. Improved *K*-Anonymity Algorithm based on Clustering.
Input: The initial data set *S*; Generalization parameter *K*;
Output: Anonymized table *AT* with *K*;
Steps: 1: Let clusters=_, record = the index of record picked randomly from *S*;
2: while Len(*S*) >= *k* do
3: if Len(clusters) <1 then
4: next record = the furthest record to record;
5: else
6: Dissimilarity Tree algorithm function ()
7: end if
8: while Len(clusters) < *k* do
9: Choose the best record and insert into the cluster
10: end while
11: while Len(*S*) >0 do
12: Get a record and choose the best cluster and insert into it
13: end while
14: end while

The steps of the clustering method are depicted in Figure 3. First, a centroid was chosen from among the available clusters. Next, the distances separating each item from the centroid were estimated. Finally, objects were grouped into categories based on the distances between them. If no objects moved within a category, the process was completed.

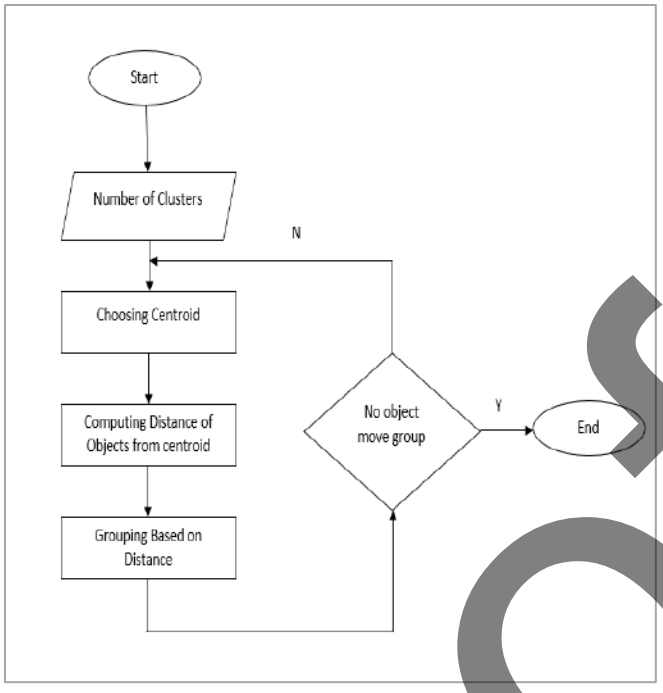

FIGURE 3. Selection of Centroid and Clustering of Data

EXPERIMENTAL RESULT

DATASET DESCRIPTION

Adult dataset: This information was obtained from a dataset provided by the United States Census Bureau. It has 32,561 entries with the following 15 attributes: age, work class, final weight, education, education number, marital status, occupation, relationship, race, sex, capital gain, capital loss, weekly hours, native country, and salary class. It also has a native nation as an entry. Location-Based Attribute; as our line of business takes into consideration the protection of location privacy.

EXPERIMENTAL SETUP

All of the experimental examples have been implemented in the Pycharm IDE in combination with various algorithms and tactics, as well as the competing facial recognition approach and various other feature extraction techniques. It is executed on a device running Windows 10 that has 8 gigabytes of RAM and 256 gigabytes of solid-state storage. When it came time to implement the models, code was written for them using Python versions 3.7 and higher.

PERFORMANCE PARAMETERS

We use NCP as a data quality assessment in order to more accurately measure data quality, as well as to standardize the evaluation criteria we use. NCP is defined in terms of qualities, as was described earlier, and it is in accordance with the definition of distance in clustering that was presented earlier. Because we need to determine the amount of information that has been lost from both the generalised records and the complete dataset, we will normalise NCP in the following manner for both types of records and datasets:

$$NCP(dataset) = \frac{\sum_{i=1}^{n} NCP(record_i)}{n}$$

$$NCP(record) = \frac{\sum_{i=1}^{d} NCP(attribute_i)}{d}$$

The variable n in the preceding equations represents the total number of records in the dataset, and represents the number of attributes that are contained in each record. As can be seen, the NCP of records and datasets is calculated by averaging them. This not only allows for direct comparison between various methods, but it also contributes to the standardisation of the measurement of the data's quality.

RESULT

The comparison graph for NCP is presented in following Fig 4.

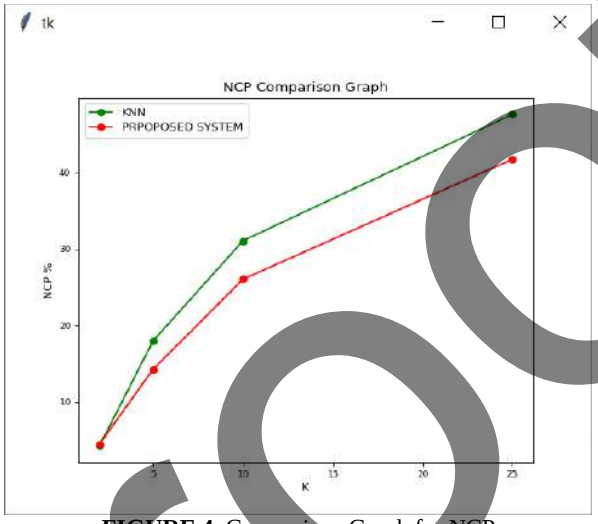

FIGURE 4. Comparison Graph for NCP

To get started, we will fix the record number n in the data set, and then we will experiment with different values for the method k that is anonymous. As shown in Figure 4, our method performs noticeably better than knn when the sample size is equal to 5000, both in terms of the metrics that measure the amount of data lost and the quality of the data. In addition, the information that is lost due to anonymization using the techniques that are now available is proportional to the size of k. The larger k is, the more records are included in the class that corresponds to it, and the greater overall information loss. We also ran a test with a larger dataset, this time handling what was essentially the entirety of the Adult dataset. Even when k is 25, our method still loses half of the information, which is approximately 15% less than the information loss of the older algorithms. In addition, the smooth slope demonstrates performance that is consistent throughout.

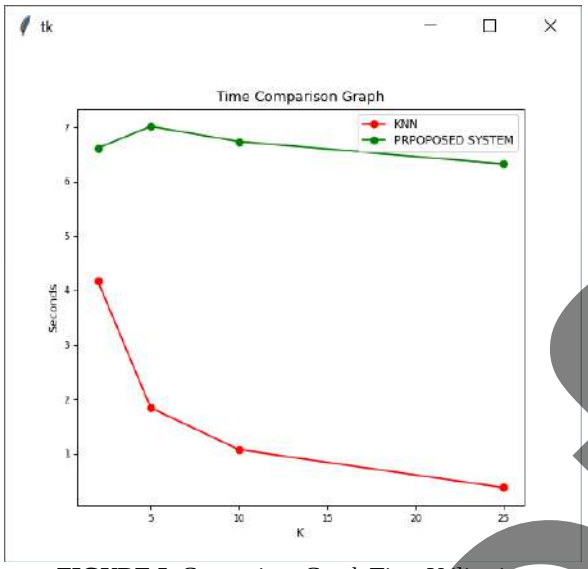

FIGURE 5. Comparison Graph Time Utilization

Fig 6 shows the NCP comparison graph for various data sizes keeping K=5 and 10.

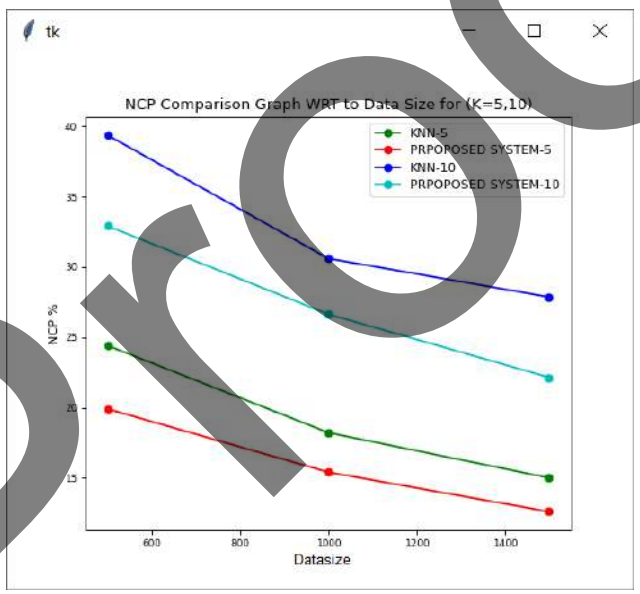

FIGURE 6. NCP Comparison Graph with respect to various data size for K=5 and 10

The RAM use comparison graph of the existing system and the proposed system can be seen in Figure 7. When compared to the suggested system, the existing system needs a higher percentage of RAM to run the computations. The y-axis of the graph displays the percentage of RAM that is being used, while the x-axis displays the algorithms.

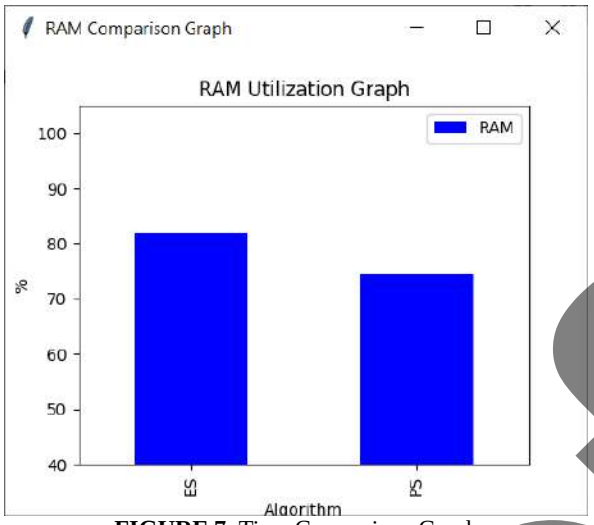

FIGURE 7. Time Comparison Graph

CONCLUSION

In this research, we present a new cluster-based k-anonymity method for the posting of data in order to protect user privacy. This algorithm, in comparison to traditional k-anonymity algorithms, is able to effectively minimise information loss, increase the accuracy of the published data set, and provide better data for subsequent data mining. All of these benefits can be attributed to the algorithm's ability to effectively minimise information loss. The proposed method makes use of a dissimilarity tree to choose the optimum initial centroid, which ultimately results in an increase in both the system's accuracy and its speed.

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